MINING CONGRESS JOURNAL

MARCH
1941

FFICIAL

MINING CONGRESS JOURNAL

Vol. 27 MARCH, 1941 No. 3

☞

We point with pride to the Journal contents this month.

Trends in production, employment and productivity are carefully analyzed by Mr. Erdreich.

Metal miners with ore bodies similar to those of the Holden mine will find food for thought on mining methods in the article by Mr. Curzon on the adaptation of the powder-blast method to the Holden mine.

Mr. Gibbons describes the Glen Burn Colliery and mine at Shamokin, Pa.

You will find many other interesting features and departments.

TABLE OF CONTENTS

Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

Published monthly. Yearly subscription, United States and Canada, $2.00. Foreign, $4.00. Single copies, $0.20. Entered as Second-Class Mail Matter, January 30, 1915, at the Post Office at Washington, D. C.

Member, Audit Bureau of Circulations

309 Munsey Bldg., Washington, D. C.

"EASIER TO INSTALL" - said all Electrical Engineers of O-B's Wedge Bond. "The mechanical method of coal extraction is so rapid that only bonds specifically designed, for rapid, simple application, are really successful", said the Superintendent of a large Ohio mine.

"ABSOLUTELY PERMANENT" - "The mechanical joint formed by the Wedge Bond Terminal assembly can be made as tight and permanent as a good weld without the danger of welding at the working faces!" was the statement of the Chief Electrical Engineer at a southwestern Pennsylvania property.

"RECLAIMABLE AGAIN AND AGAIN" - said the same Engineer. "In fact we have found that the life of O-B's Wedge Bond is 50 to 75% greater for room and entry work than any other type of bond we have used!"

"HIGH CONDUCTIVITY" - "The current carrying capacity of this bond is excellent. With well-laid track we have found that the bond retains its high conductivity during its entire life on each installation."

"CONSIDERABLY LESS EXPENSIVE" - "The Wedge Bond is easy to install with unskilled or untrained labor and its entire sequence of application - installation, inspection, reclamation and reinstallation - is considerably more efficient and definitely less expensive," was the reaction of another Electrical Engineer.

Make a trial installation of O-B Wedge Bonds at your own mine and see for yourself how a Wedge Bonding System will save you time and money!

2265-M

OHIO BRASS

MANSFIELD OHIO·U·S·A

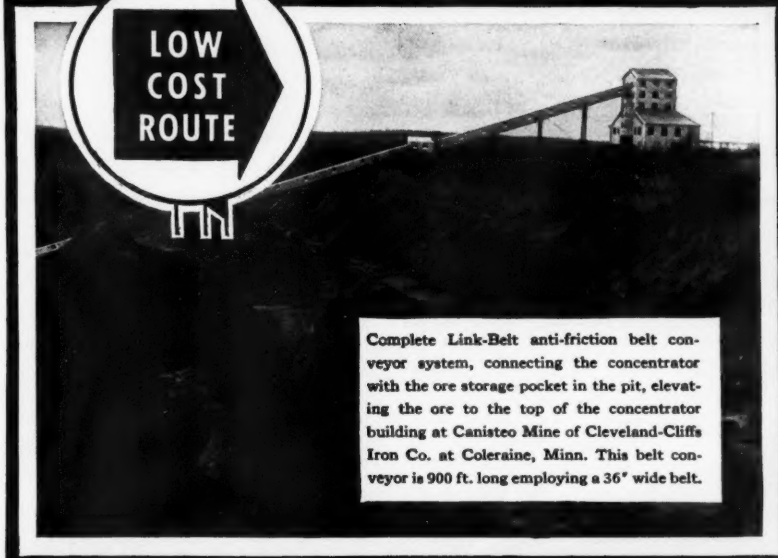
Canadian Ohio Brass Company, Ltd. Niagara Falls, Ont., Canada

COMPLETE O-B PROTECTION FOR CONTINUOUS PRODUCTION

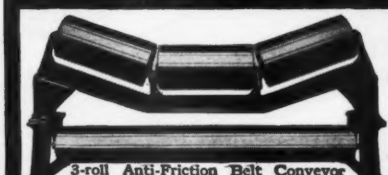
Highway To Lower Handling Costs

√ *Check these* LINK-BELT FEATURES

for Efficient Belt Conveyor Operation



Complete Link-Belt anti-friction belt conveyor system, connecting the concentrator with the ore storage pocket in the pit, elevating the ore to the top of the concentrator building at Canisteo Mine of Cleveland-Cliffs Iron Co. at Coleraine, Minn. This belt conveyor is 900 ft. long employing a 36" wide belt.



3-roll Anti-Friction Belt Conveyor Troughing Idler and Return Idler.

Positive Self-Aligning Anti-Friction Idler.

√ **1. Anti-Friction Efficiency.** Idlers are fitted with roller bearings which take high radial and thrust loads.

√ **2. Strength and Simplicity.** Riveted idler frames, strong brackets and sturdy rolls make a trouble-free assembly. No bolts or nuts to work loose.

√ **3. Ease of Lubrication.** High-pressure grease system is readily accessible and idler bearings are protected by labyrinth seals which retain grease and keep out dirt.

√ **4. Belt Protection.** Idlers are smooth with rounded edges. Narrow gap between rolls prevents pinching.

√ **5. Accurate, Balanced Rolls.** Accurate machining assures perfect alignment of bearings and uniformity of parts in the complete idlers.

The HEART of the efficient belt conveyor of today is the idler. To this all-important element, Link-Belt engineers have given continuous attention, as a result of which present Link-Belt designs offer the most in dependability and low service cost.

Get information now on better belt conveyor equipment—whether for modernization or new installation needs.

LINK-BELT COMPANY

Chicago, Philadelphia, Pittsburgh, Wilkes-Barre, Huntington, W. Va., Indianapolis, Denver, Kansas City, Mo., Cleveland, Detroit, St. Louis, Seattle, Toronto, Vancouver

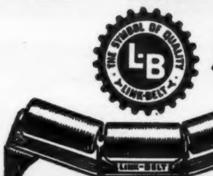
Offices, warehouses and distributors in principal cities 8402-G

OTHER LINK-BELT EQUIPMENT INCLUDES: Complete plants for Crushing, Screening, Storing and Reclaiming Ore, Coal, etc. . . . Conveyors and Elevators of all types . . . Feeders . . . Vibrating Screens . . . Roto-Louvre Dryers and Coolers . . . Skip Hoists . . . Car Spotters and Haulage Systems . . . Portable Conveyors and Bucket Loaders . . . Silent and Roller Chain Drives . . . Speed Reducers . . . Variable Speed Transmissions . . . Chains and Attachments of all types (Malleable Iron, Promal and Steel) . . . Sprockets . . . Elevator Buckets . . . Gears . . . Clutches . . . Couplings . . . Base Plates . . . Take-Ups . . . Friction Fighter Self-Aligning Ball and Roller Bearing Units . . . Babbitted Bearing Units . . . Send for Catalogs.

LINK-BELT

BELT CONVEYOR EQUIPMENT

A TYPE FOR EVERY SERVICE



IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • TAKE-UPS • DRIVES

MORE TONNAGE *with*
GOODMAN SHAKER CONVEYORS

At the Working Face

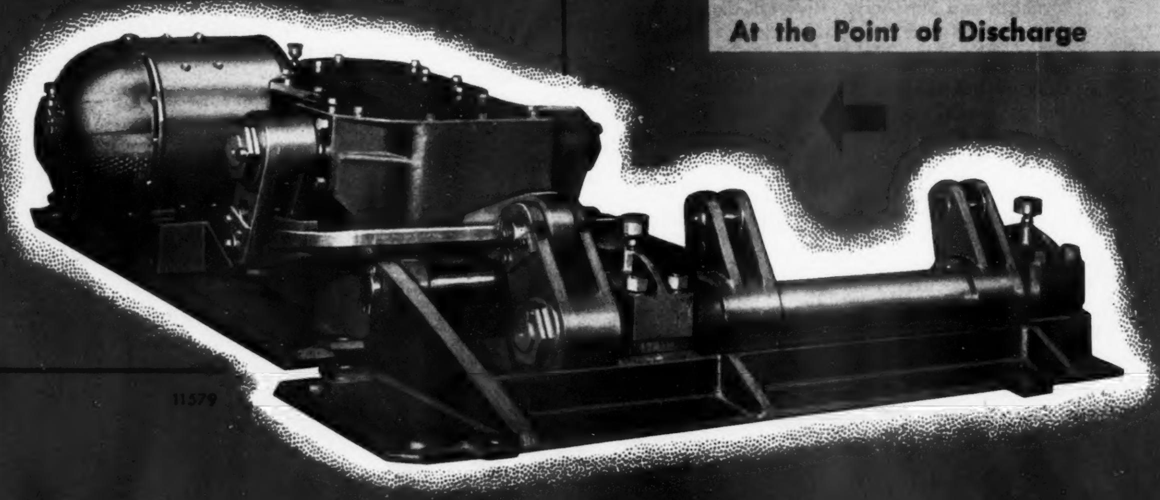
THE GOODMAN AUTOMATIC DUCKBILL

The duckbill converts the shaker conveyor system from one of transportation to one of loading and transportation.

THE GOODMAN SHAKER DRIVE

The large capacity G type shaker drive unit is now suitable for use in low coal when equipped with the new side drive attachment.

At the Point of Discharge



Goodman Shaker Conveyors and Duckbills are being used successfully in the handling of coal, ore, rock, salt, borax, gypsum, potash and hot dolomite sinter.

COAL IS DEFENSE

GOODMAN MANUFACTURING COMPANY

HALSTED STREET AT 48TH · CHICAGO, ILLINOIS

A JOURNAL FOR THE ENTIRE MINING INDUSTRY—PUBLISHED BY THE AMERICAN MINING CONGRESS

MINING CONGRESS JOURNAL

RUSSELL C. FLEMING
Editor

Vol. 27 MARCH, 1941 No. 3

TRENDS IN EFFICIENCY

THE mining industry collectively is noted as being progressive and aggressive in the employment of new methods and new equipment to increase efficiency and lower per-ton costs. During the depression years grim necessity accelerated this process, when only the most efficient concerns could hope to survive. As a result, now, when probably the greatest demands in history are to be made on parts, if not all of the industry, mining is in improved position to meet those demands. Greater efficiency, as measured in terms of output per man hour, permits concerns to increase production for defense needs with less training of new personnel. The strain of increasing production is less through the more intensive utilization of facilities already developed.

In this issue of the JOURNAL the article on Production, Employment, and Productivity in the Major Extractive Industries gives a comparison of this trend, as measured in output per man-hour, among seven branches of the mineral industry. Some startling conclusions stand out from that comparison. Whereas the average output per man-hour for all has advanced 41.6 percent in the period from 1929 to 1939, inclusive, copper mining, and lead and zinc mining have advanced 69.2 percent and 62.1 percent respectively, in the same period.

Of particular and large significance to coal mining is the fact that in the field of fuels, petroleum, natural gas and natural gasoline have increased output per man-hour 82.8 percent in the period, the greatest technologic advance of all. These fuels are directly competitive with coal, and in that increase in efficiency lies a good part of the explanation as to why they have been able to maintain and increase their competitive position at the expense of coal.

On the other hand, the coal mines have been mechanizing in the same years. But measured in terms of output per man-hour, the advance has been far less than is generally supposed. The technologic improvement in bituminous coal mining has amounted to only 17.6 percent in the period and anthracite mining to 35.1 percent. The advance in both industries has been below average and bituminous coal mining has by a wide margin had the least total advance of all.

The cost of labor is one of the largest single items in overall production cost. Is it to be wondered at, then, that the liquid and gaseous fuels have steadily been advancing their competitive position and total sales at the expense of the solid fuels? Other factors enter into the situation, of course, but it cannot be denied that coal mining, as a whole, despite the great advance made in mechanization, has not kept pace with other industries in improving efficiency and lowering costs through a more widespread technologic improvement.

The conclusion is clear. The mechanization so far accomplished is only a start. Coal mining must not only keep pace with other industries in increasing efficiency but must redouble the effort in order to catch up. Therein lies the salvation of both the capital and the labor employed in the coal industry. Other industries are not going to stand still—progress is inevitable—and coal mining must look forward with renewed and grim determination to the task of meeting and beating competition in obtaining greater efficiency and producing at less cost.

PRIORITIES ON EQUIPMENT?

WITHOUT coal and copper, zinc and iron ore, lead and manganese and other minerals, preparation for defense would come to a standstill. And with mining equipment and parts manufacturers being pressed for production of engines of war, the mining industry cannot produce to the fullest unless replacement parts and new equipment are available as needed.

This problem must soon be met. It is not a question of guns or butter, for both types of production are equally necessary. To what extent can manufacturing facilities be turned to direct defense production without hindering production of equally important raw materials for defense?

The magnificent setting of the Holden mine. The mill can be discerned nestling in the valley at the lower right center.

Photo by H. L. Deits.

MINING METHODS Used at the HOLDEN MINE

The powder blast method of mining as employed at the Holden Mine and here described, is a development of methods used at Alaska Juneau and a few mines in Canada. Careful experimentation has proved the modifications necessary to adapt the method to local conditions.. A system of undercutting wide ore bodies by this method will become standard practice at the Holden mine. They have also developed a system for using diamond drill blast holes, both in long holes and ring drilling for stoping in narrower portions of the vein.

By J. J. CURZON
Manager, Chelan Division
Howe Sound Company

+ + +

THE outstanding feature of the Holden operation has been the success of the Powder Blast Mining Method, patterned after the methods used at Britannia, British Columbia, and Alaska Juneau. Just recently the Box property in northern Canada has adopted this same method. An excellent article explaining in detail this method of mining appears in the August, 1940, issue of the Canadian Mining and Metallurgical Bulletin.

Geology

The geologic history of the Holden area is an integral part of the history of the Cascade Mountain Range. The structure is very complex, and the rocks, which have been subjected to intense metamorphic action, are portions of a roof pendant and consist of gneisses, schists, and quartzites that are often difficult to correlate. Many granitic dikes, large and small, and lamprophyre dikes, generally small, are intruded in the formations. Considerable silicification occurred with the ore deposition. Although the geology is complex, the rocks have some characteristics in common; they are all hard and abrasive.

The chief copper mineral is chalcopyrite. Other sulphides are pyrite, pyrrhotite, sphalerite and galena (very little). Some gold is distributed throughout the ore body without any evident relationship to levels or to the hanging and footwalls.

Early development work in the Holden mine proved the rock to be hard and to stand without timbering. The ore body was found to vary in width from 30 to 80 ft., 55° to 65°, average 800 ft. in length on the different levels, and to extend about 1,100 ft. vertically above the haulage level.

Mining Methods—Description of Powder Blasting

This deposit of low-grade ore was determined to be of sufficient size to produce economically a daily tonnage of 2,000 tons if mined by the powder blast method.

This method can be classed as a type of shrinkage stoping requiring no stope timbering. After the drawing points or bulldoze chambers are completed and the ore body is undercut from the hanging wall to the footwall, the ore is then shot down in large blasts, similar to quarry coyote shooting. In the ordinary type of stoping the ore is drilled and blasted by miners working from the top of the broken ore, whereas in this method, once the undercut is completed no one enters the open stope again, all the work being done in the solid rock above the stope.

The success of this method depends entirely upon the accuracy of the geological and surveying records. The mine maps must be accurate and up to date. The raises must be kept on line

and holed through at the desired points. The success of each powder blast depends upon the correct calculation of the charge, which is based upon the character of the ground, the spacing and depth of pockets, and the location of faults or dikes that may affect the action of the powder. Perhaps the most interesting phase of the surveying has been the use of the hanging compass, which is now used for all raise work, stope and powder blast surveys. Base level surveys are done by transit. Diamond drilling is used to great advantage to outline the ore body and form the basis for the tonnage and grade calculations.

Mine Development

After the footwall of the ore has been outlined by diamond drilling, the bulldoze chambers are located 15 ft. from the footwall at intervals of 40 ft. The main raises from the haulage level are driven 200 ft. apart and connect directly to a bulldoze chamber on the mining level. From these main ore passes are driven wing raises which eventually lead to all of the other chambers located on the stoping level. A section of the entire mine resembles a row of trees with many branches reaching up and spreading out.

Stope Development

A footwall raise, 5 ft. by 6 ft., is driven at 40° due north from the center of the grizzly. From this raise wings are collared east and west, also at 40°, that follow the footwall of the ore and intersect each other. At the same time a hanging wall wing at 40° is collared off the north wing at a point 10 ft. vertically over the throat of the chamber. These wings outline both the hanging wall and footwall ready for undercutting.

The undercutting, which is done chiefly by drifter drills, consists of simply mining out the ground by widening the funnel-shaped openings above each chamber. As this work progresses, the footwall and hanging wall wings are connected through the stope and the contours of the foot and hanging walls are straightened out until eventually a series of funnel-shaped openings are made above the chambers, and the ore body is completely undercut from wall to wall and as far along the stope as desired. The high points between all chambers are called "hogbacks."

Ore Breaking

The spacing and location of the number of pockets depend entirely on the conditions for each blast. No two shots are ever the same; each must be considered as a distinct problem. A burden of 35 ft. has been found to be about the economic limit, as anything over that limit, unless conditions are ideal, might lead to trouble. Another rule-of-thumb is that the depth of burden should not exceed two-thirds the width of the undercut. All underground planning is done by the chief engineer in conference with the mine superintendent. Then it is finally passed upon by the manager. Such a close balance exists between the engineering and mining departments that perfect coordination between them is absolutely necessary for the success of the property and the safety of the men.

The charges for each pocket are calculated independently by two or three men from maps prepared by the engineers showing the exact location of the pockets with respect to the contours of the open stope below. After each man has made his recommendations, the manager, or umpire, is called in to decide on the loading. The geologist enters the discussion to advance any ideas on structure which may affect the shot.

The actual powder charge calculation is made by two methods, from which a mean figure is derived. The Britannia method is to allow one case of dynamite for every foot of burden up to 30 ft., and two cases for every foot over 30 ft. of burden. This is the conservative figure.

The estimated tonnage is then multiplied by explosive consumption factors, ranging from 0.5 to 1.0 lb. for explosives per ton of broken ore, which gives a basis of comparison with the Britannia method. If the shot is difficult it may require up to 1.0 lb. or more explosive per ton; while if the shot is easy 0.5 lb. of explosive per ton may be sufficient. The factor 0.75 lb. per ton is customary for average charges. These calculations cannot be considered as exact, but must be based on common sense and experience.

A semi-gelatin explosive having a rated confined velocity of 22,000 ft. per second, made up in cartridges 5 in. in diameter by 10 in. long, was first used. The cartridges were removed from the boxes and stacked in the end of the pockets like a stack of wood.

This charge was detonated by a half-case of 60 percent nitroglycerine dynamite with two No. 6 instantaneous electric blasting cap primers wired in series and embedded in the center of the half-case.

Muck from the powder blast workings has been saved and is used as backfilling after the loading has been completed. This material is tamped in as tight as possible, because the success of the shot greatly depends upon the tamping. All of the pockets are wired in series and carefully tested at intervals during the backfilling.

The first blasts were fired by a blasting machine from the 550 level portal, the top mining level. Next, all of the shooting was done from the 1,100 level portal through a magnetically controlled switch in the 440-volt blasting circuit. Now all the powder blasts are connected to a special blasting circuit passing through a series of locked switches and shot from the shifters office near the haulage level portal. Great care is taken to be sure that no one is underground at the time a large blast is shot.

Development in Blasting Practice

Recent developments have resulted in larger cartridges, 5 in. by 16 in. and 5 in. by 20 in., which are sufficiently long to allow for cording with two 1⅛ in. by 8 in. sticks of 60 percent N. G. dynamite. The larger cartridges also speed up the actual loading of the pockets. The cartridges do not require a special primer as the electric blasting caps are inserted in the ends of the two 60 percent N. G. dynamite sticks. This cartridge then becomes the primer for each pocket. By cording the large cartridges the unconfined velocity of the explosive is speeded up to 19,000 ft. per second.

Although the greatest efficiency is obtained from the charge when all the pockets are fired simultaneously, it is sometimes desirable to take out a portion of the blast first to relieve other pockets which follow, in the same way that cut shots in an ordinary round are shot first. The use of delay E. B. caps, however, sometimes leads to grief because the delays do not always detonate at just the same instant, and the desired effect of several pockets going together is minimized. In one particular shot at the end of a stope where the effect of throwing the broken ore laterally rather than down was desired, a series of pockets using four delays were successfully blasted. The latest suggestion is to connect the pockets using the same numbered delays by Primacord, which will guarantee the pockets with delays going together.

Pictures by Ward Carithers.

Views of the Holden townsite, mine and mill. Photo at lower right taken by moonlight

Owing to the character of the ground, a fast explosive with a high shattering effect was first considered necessary, especially along the footwall. Possibly the full effect of the explosive is not utilized, and considerable thought has been given to the use of explosives of different speeds within the same blast. The spreading action of a slower speed explosive should give a more uniform fragmentation and possibly an increased tonnage factor. The spreading action along the footwall would also be desirable, if the charge is heavy enough to blast out the tight ground.

Theoretically, if two pockets are shot simultaneously, one loaded by explosive having a confined velocity of 20,000 ft. per second and the other by a charge with a confined velocity of 10,000 ft. per second, the mass directly affected by the first pocket should be in motion ahead of the mass affected by the second pocket. In this way the desired effect of using electric delays might be obtained by using powders of different speeds fired simultaneously.

In following out this line of reasoning powders of various speeds were used in the same blast with varying success. It so happened that about this time the stope was getting narrower and the footwall abnormally difficult to pull. The slower powder on the footwall did not seem to have the necessary kick to pull the footwall clean, resulting in several partially successful blasts. The latest tendency has been to try and use the same speed powder in all pockets fired simultaneously if possible, but with delays when necessary; but the thought still persists, if powders of different speeds can be used to advantage in quarry shooting, why cannot the same principle be applied to powder **blasting?**

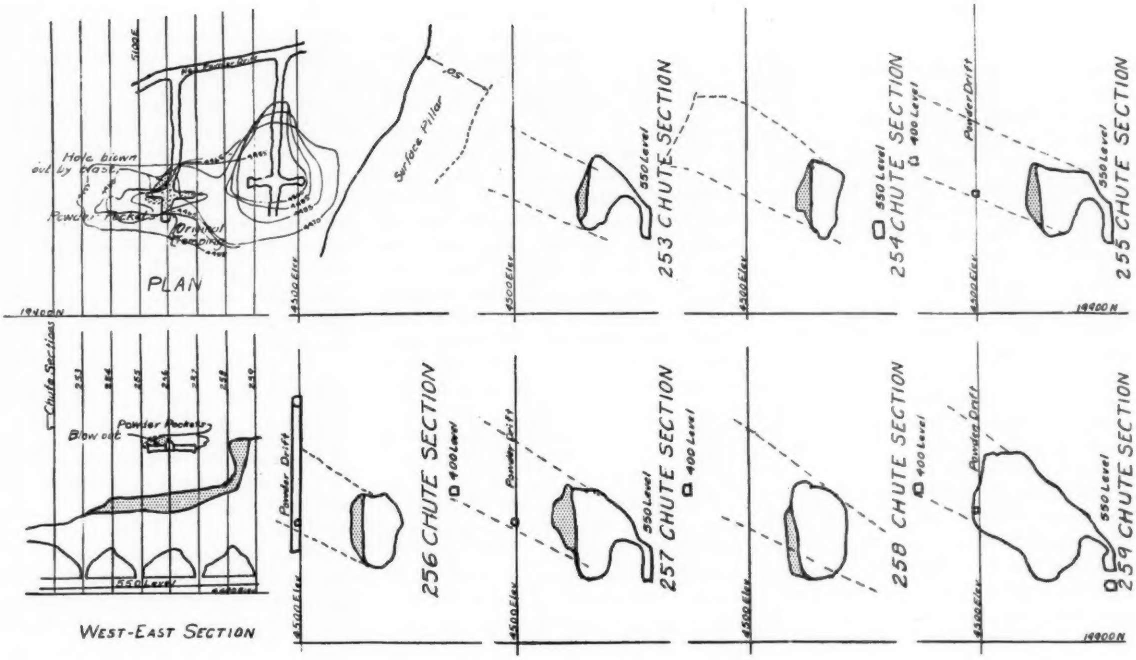


Fig. 1. Powder Blast—Depth of burden too great for width of undercut

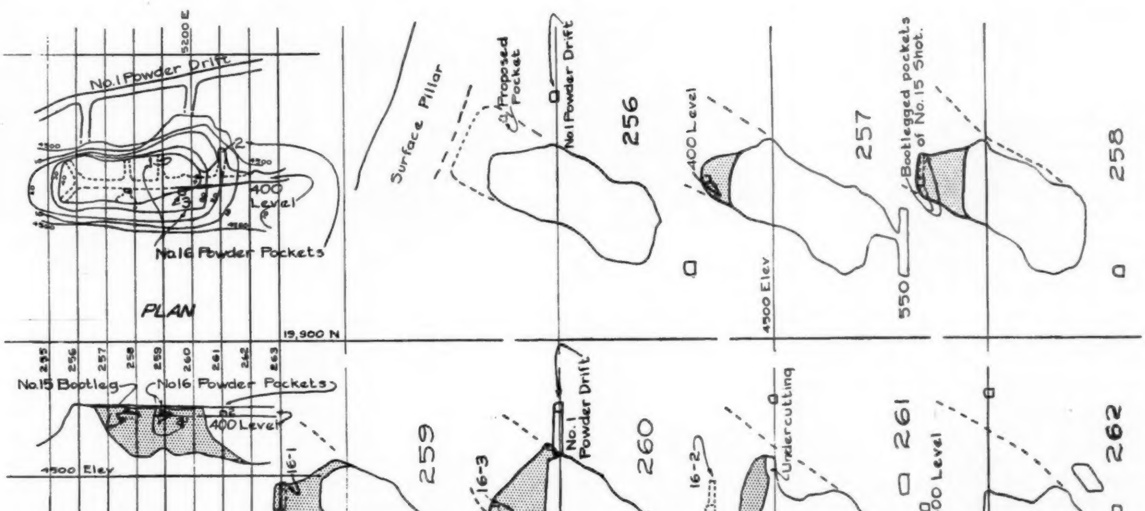


Fig. 2. Powder Blast—Insufficient backfilling caused No. 2 pocket to blow out into the 400 level drift

Powder Blast Failures

Several of the blasts have been either partial or total failures. In one blast of 135 cases, see Figure 1, the depth of burden was too great for the width of the undercut. The tamping remained intact, but the force of the powder blew a hole through solid rock to the crosscut on the other side of the drift. The charge must be large enough to break the ground. Insufficient backfilling is also a common cause of failure, see Figure 2. In another case a pocket failed completely, probably due to a mistake in wiring, as the shot was entirely successful when combined with a later blast. All powder blast pockets will work if a few simple rules are followed. The burden must not be excessive nor over two-thirds the width of the undercut; the pockets should be spaced evenly, if possible, and tamped correctly; the electric hookup must be right. If a key pocket fails, the entire blast may be a failure.

Powder Blast Results

From the first blast in May, 1938, up to the end of 1939, a total of 53 shots were fired, ranging in size from a small cleanup single pocket of 25 cases to a large blast using 525 cases in 15 pockets shot on December 10, 1939. The smallest shot of 25 cases produced 5,300 tons, giving a factor of 0.57 lb. of explosive per ton of ore. The large shot, with 525 cases, gave the same factor of 0.57 lb. per ton with a production of 46,000 tons of broken ore. The total estimated tonnage for the 53 powder blasts was 577,622 tons, and the broken ore produced was 665,873 tons, showing how closely the estimated and actual tonnages can be figured. The estimated tonnages are always calculated conservatively. The blasts in all used a total of 8,395 cases, and resulted in a factor of 0.63 lb. of explosive per ton of ore broken.

During 1940 conditions were not as favorable for powder blasting because some of the stopes were passing through narrow areas. A total of 40 powder blasts were detonated ranging in size from a few pockets up to a group of 20 pockets. These blasts resulted in a factor of 1.66 lbs. of explosives per ton of broken ore for primary breaking in producing 398,046 tons. Since production began in 1938, a total of 93 powder blasts have been detonated, resulting in an average factor for primary breaking of 0.83 lb. of explosives per ton of ore broken. Secondary breaking during this period has amounted to 0.199 lbs. of explosives per ton, thus making the total explosives for primary breaking by powder blasting and secondary breaking in the bulldoze chambers amount to 1.029 lbs. of explosives per ton of ore produced.

Typical examples of successful powder blasts are shown by Figures 3 and 4.

Problems Encountered in This Type of Mining

Recent development work has shown that certain portions of the stope will be narrower in width than 30 ft. and other portions greater than the 80 ft. found in the first stoping operations. Stoping problems encountered during 1940 have shown that it is extremely difficult to powder blast even as narrow as 35 ft. and practically impossible for lesser widths. Also, in undercutting the stope for a width of 100 ft. or more, a dangerous mining problem is found, which requires a change

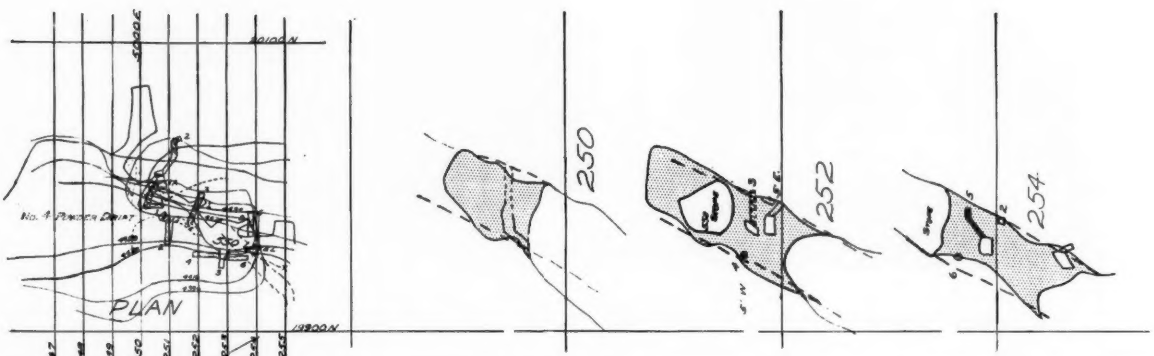


Fig. 3. This powder blast broke the expected tonnage of 29,000, using .65 lbs. of explosive per ton of ore broken

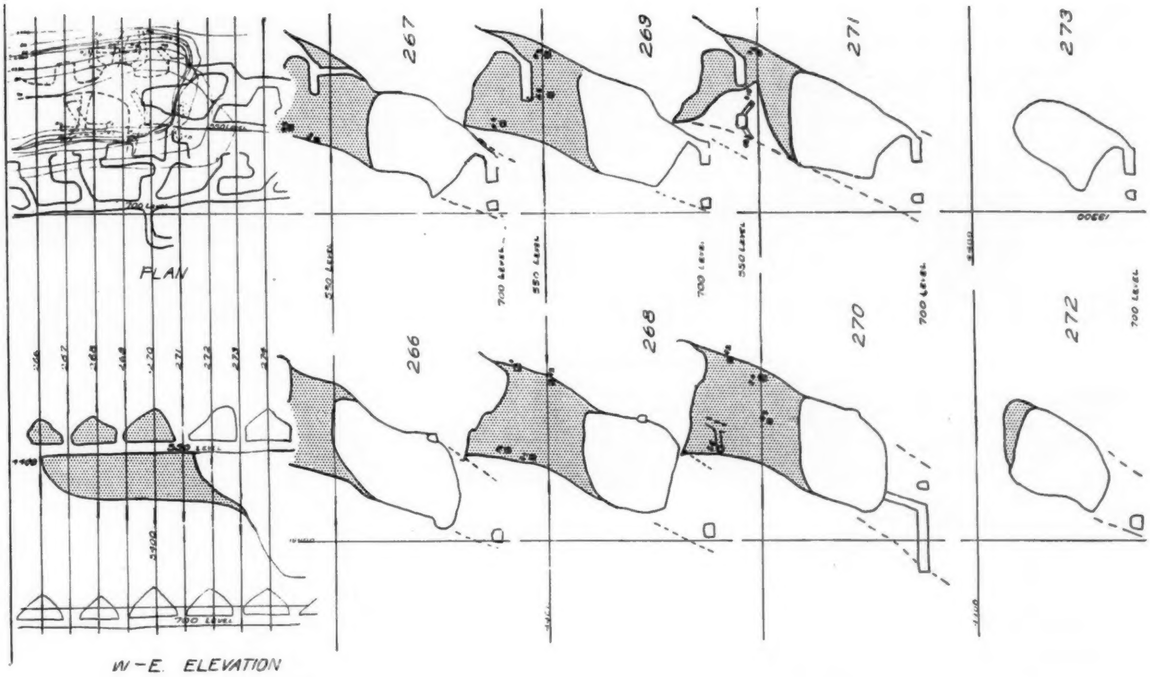


Fig. 4. This blast broke 46,000 tons of an expected 50,000 tons. Pockets 8 and 10 partly failed due to poor confinement

in the undercutting system. Even though the rock is hard and strong, when a block of ground 100 or more feet wide is completely undercut for several hundred feet, there is always the danger of the back slabbing off to slips and faults which cannot be detected from below.

New Method of Undercutting Wide Ore Bodies

For these sections of the stope a new method was devised which starts the undercut in the same manner as formerly by using rock drills and completes the undercut by the use of a series of small powder blast pockets.

After the bulldoze chambers are located, the footwall wings are driven to intersections as before. The hanging wall wings are put through to the hanging wall where a hanging wall service drift is driven along the hanging wall contact to connect all of the hanging wall wings from each bulldoze chamber. Service is then along the hanging wall drift and not along the footwall of the undercut, as was customary before.

When the wings and service drift are completed, the undercut begins in the normal way by cutting out above each cone, but leaving a narrow supporting pillar over each hogback. Then a narrow shrinkage stope is carried up the footwall to the desired height of the undercut. When this is completed the undercutting by conventional stoping methods is completed and all equipment is removed from the footwall stope cut.

From this point on the undercutting is done by correctly spaced small powder blast pockets driven off the hanging wall wings. There are two faces to blast to at the start, down into the open cones above each bulldoze chamber and toward the opening previously cut along the footwall. The pockets are shot retreating up the hanging wall wings until finally the entire stope is undercut from wall to wall.

The possibilities of this new system is illustrated by Figure 5, which shows the series of steps taken to undercut a trial portion of the 1,250 stope. The ground in this stope, although hard and requiring the fastest semi-gelatin explosive in the 5-in. x 10-in. cartridges, is nevertheless somewhat broken up; and it is very doubtful if the back would remain unsupported over the width of the undercut.

This new method has proven so successful that it will be adopted as the standard method of undercutting wide areas in this mine. It may be that either this system or an adaptation thereof could be successfully applied to other properties.

Mining Method for Narrow Stopes

In March, 1939, the Canadian Mining and Metallurgical Bulletin published an article, "Stoping at Noranda," by Hall, Porritt, and Carmichael, describing their method of using diamond-drill blast holes for producing tonnage with safety. A year later, March, 1940, an article on the Aldermac mine called "Mining Large Ore Bodies," by Corlett and McLeod, was published by the same journal.

When these articles were being studied we were impressed by the evident possibilities in the method and also by the fact that many of the stope section maps in the article resembled actual stope sections in the Holden mine. It was easy to visualize that in portions of our stope this method would seem to have distinct advantages over straight shrinkage stoping, especially when production could be carried on in a stope where powder blasting had become impractical.

In order to get some first-hand information on just what was being done by this method, Mr. J. K. Brooke, mine superintendent, visited some of the

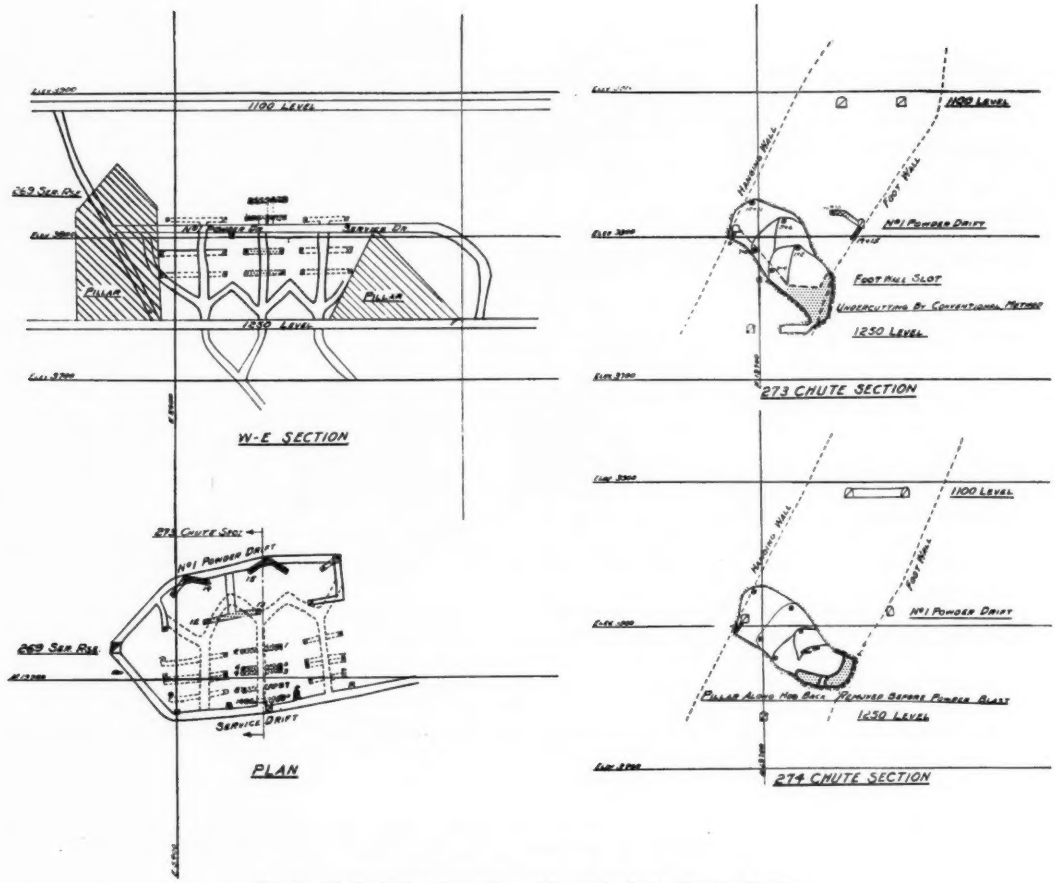


Fig. 5. Method of undercutting wide ore body by Powder Blasting

mines in eastern Canada that are using the blast-hole method with such success. Mr. Brooke returned with much valuable information on the various systems of laying out the holes, and preparations were begun to give the method a trial.

In preliminary studies a burden of 5 ft., based on early blasting experience, was considered the limit that could be pulled in our ground by blast holes. Two general systems seemed to be feasible; namely, system 1, holes drilled in a horizontal plane, and system 2, holes drilled in a vertical plane. The choice of the system would depend upon several factors, such as size and outline of the stope, amount of development work necessary to get into position to drill, and the adaptability of existing raises and drifts for drilling set-ups. System 1 could be used by drilling rings or holes in a horizontal plane off any main raise or former ore pass which provided sufficient room to operate the drills. System 2 could be used with existing drifts or special drilling drifts along the strike of the ore body. Accordingly, two typical locations were chosen and test drilling began.

The first holes were drilled with the standard E X E coring bits producing a $1\frac{7}{16}$ in. diameter hole. The next holes drilled were $1\frac{3}{16}$ in. in diameter using various types and designs of bits, both non-coring and coring bits, which included the type with a thin shell that cuts a large core and the type that cuts a small, "pencil core." The larger hole is best from the explosive standpoint because more powder can be utilized, but the smaller hole proved to be the most economical in the balance between cost per foot of hole drilled and tons of ore broken per foot of hole.

As core recovery is not necessary in drilling blast holes, drilling speed then becomes the important factor. The size of the hole necessary is dependent upon the character of the ground and the amount of burden each hole is designed to pull. The smaller the hole, the greater the drilling speed. The larger holes take longer to drill and the diamond loss is greater. To determine the size of the hole desired then becomes a problem of cost per foot of hole, weighed against the amount of ground, reduced to a tonnage basis, that each size hole can be expected to break. Good explosive factors are obtained because the explosive is distributed evenly throughout the mass of rock to be broken.

Considerable emphasis throughout the country is being given to the development of a satisfactory electric high-speed diamond drill. Although the electric drill was not successful in recent trials at the Holden property, because of the character of the ground, there is certainly plenty of merit to the scheme. With so much drilling talent working on this problem, the right combination of bit design, size of hole, and drilling speed will eventually be grouped into the design of a machine which will be used successfully in all kinds of ground.

Figure 6 shows a portion of the 1,100 stope where system 1, horizontal holes, was tried. A total of three long-hole blasts have been shot in this stope, producing about 15,650 tons

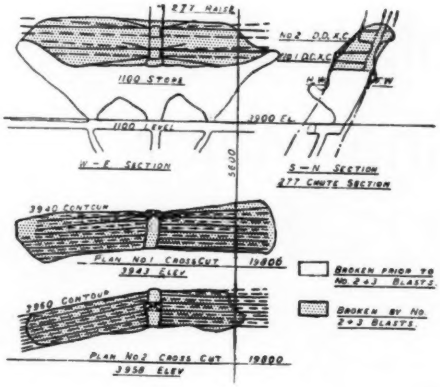


Fig. 6. Long Hole Method of Blasting

with a factor of 0.36 lb. of explosives per ton of ore broken. One serious difficulty was found with the holes tending to bootleg on the end where there is no opening to blast to. In this particular case the net result was a shortening of the stope which, if allowed to continue, would cause the stope to pinch out by the time it had reached the level above.

An attempt is now being made to square up the ends of the stope by springing the ends of the holes immediately above the bootlegged ground in order that sufficient charges may be loaded to clear up the face of the stope. Another plan is to remove the small pillars remaining between the crosscuts off the raise and thus create a slot to break to by down holes from the level above.

When the drilling was first begun in a portion of the 900 stope on the east end immediately above the drawing points, it was only done from the drift along the footwall. The holes showed a tendency to bootleg where they were dead-ended against the hanging wall. A hanging-wall drift was then driven along the contact of the ore and rings of holes drilled from each drift in the same plane. The results obtained with the 900—Long Hole Blast No. 4 were very encouraging and definitely prove that this mining method has great merit.

Profiting from experience with the horizontal holes in the 1,100 stope and the footwall holes only in starting the 900 stope, the block of ground immediately below the 700 level and the pillars above was laid out to be mined by the Noranda system, shown by Figure 7. These rings are spaced 5 ft. apart below the level and 10 ft. apart above the level. The amount of drilling needed for the entire block of ground is estimated at 15,590 ft. The expected tonnage is 38,000 tons, which should be broken with about 0.25 lb. of explosives per ton of ore, if all goes well. During the experimental work in 1940, 19,250 tons of ore were broken with a factor of 0.357 lb. of explosive per ton. The footage factor of 1.83 tons per foot of hole is too low and will be improved by greater spacing of rings and better ring patterns.

Many advantages can be justly claimed for the blast-hole method over shrinkage stoping in areas where powder blasting is not desirable or practical. Perhaps the greatest single feature is the safety factor, because in this method all necessary development work and drilling of holes is done in solid rock, while in a shrinkage stope the miners are constantly working under the back of the stope.

Another advantage is that a block of ground can be drilled out ahead of production, and the rings of holes blasted at will. With several stopes of varying grade drilled out, the grade of the mine output can be quickly and easily controlled. In shrinkage stoping, much of the broken ore must be retained in the stope to permit mining to continue. This would be a disadvantage if the ore was susceptible to oxidation or if the tonnage of broken ore was needed in a hurry.

Although the actual cost per foot of diamond-drill hole is greater than the cost per foot of rock-drill hole, the overall efficiency of the diamond-drill hole offsets this difference. A burden of 5 to 6 ft. can be placed on long blast holes in ground where a 30-in. burden on rock-drill holes would be considered the maximum. This fact is reflected directly in the amount of explosives necessary to break the ground.

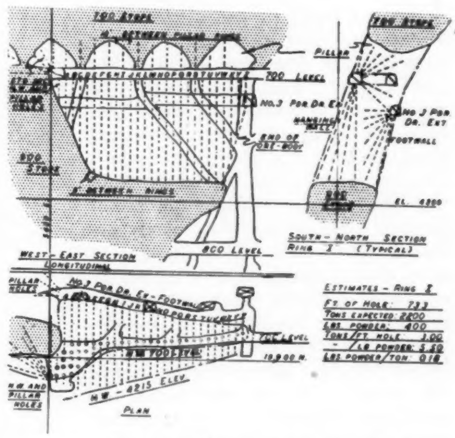


Fig. 7. Long Hole Blast employing Ring Drilling

After nearly three years of continuous operation, it can now be stated that powder blasting is an excellent method to mine this ground when the ore is wider than 35 ft. and reaches the greatest efficiency when the stope is 60 ft. or more in width. For those portions of the ore body that are 35 ft. or less in width, the blast-hole method seems to have definite advantages over shrinkage stoping. In our opinion, the blast-hole method will not only become standard practice for portions of this ore body but will eventually be adopted in other properties south of the Canadian border, where conditions are favorable.

Old Dominion

The Old Dominion Mine at Globe, Ariz., which yielded $134,000,000 worth of metal and paid over $14,000,000 in dividends is now only a water well, with no separate corporate existence.

The stockholders, at a special meeting in Portland, Me., in February, voted dissolution of the Old Dominion Copper Mining and Smelting Company. The physical property was sold some time ago to the Miami Copper Company, which continues to pump water from the Old Dominion shaft for use in their concentrator and leaching plant. Thus officially passes out of existence one of the most famous copper mines of the southwest during the early days of this century.

In 1895, the Lewisohn brothers bought the company and built a smelter, and also connected Globe by rail to the trans-continental line. Until 1920, Old Dominion was one of the most profitable copper mines in the southwest, although not the largest.

Production, Employment, and Productivity Trends in the Major Extractive Industries, 1929-39

By EMIL ERDREICH
Economic Analyst
Division of Mineral Industries
U. S. Bureau of the Census

We hear much about the tremendous technologic advance of the mining industry. Mr. Erdreich here goes to the heart of this development with a careful and complete statistical analysis of the advance in technology since 1929 as expressed in output per man hour in the major mineral industries. Production and employment in the fields of iron-ore mining, copper mining, lead and zinc mining, crushed stone producton, petroleum and natural gas production and mining of anthracite and bituminous coal, are analyzed on a basis which gives a means of comparison among these branches of the industry.

+ + +

THE National Defense Program requires a vastly expanded production of vital minerals, particularly metals, to satisfy the needs arising out of the present war. Whether these demands can be met successfully depends, first, upon the adequacy of the existing plant facilities and, secondly, upon a sufficient supply of skilled labor. Since 1929 the reservoir of skilled mine labor has been steadily depleting, partly because of retirement due to old age and other reasons, partly because of migration and shifts to other occupations necessitated by unemployment and depression, but mostly because of the failure to train new workers during this period. On the other hand, the last decade witnessed an unprecedented rise in the productivity of labor. The 1929 peak production can now be attained with much fewer workers than the number then employed. It is hoped that the present article will shed light on that phase of this important problem which deals with the adequacy of the present labor supply in the more vital extractive industries. It furnishes also the estimates of the production capacities of mines and mills producing copper and zinc, both commodities having been recently placed by the Presidential Proclamation under export license control to insure their sufficient supply for domestic needs.

During the 1929-39 period a spectacular reduction in man-power requirements took place in the extractive industries. The decrease was most marked in the copper-mining industry, where the volume of employment in 1939 was 56 percent below the level prevailing in 1929. Steep declines likewise occurred in other important branches of metal mining, particularly in iron ore and lead and zinc mining. Employment in the production of the mineral fuels (bituminous coal, anthracite, petroleum, natural gas, and natural gasoline) has been better sustained, but even in these industries the man-hours worked in 1939 ranged from 35.5 to 48.4 percent less than in 1929.

Part of the decrease in employment opportunities in the extractive industries in this period reflected the curtailment of production. With the exception of the crude petroleum and crushed stone industries, all of the more important branches of the mineral industries showed a substantial reduction in the physical volume of production between 1929 and 1939. A sizable share of the decrease in employment, however, was accounted for by the rising output per man-hour. For the seven most important branches of the extractive industry, output per man-hour increased by over 40 percent between 1929 and 1939. This increase is particularly noteworthy, as constantly increasing physical difficulties are encountered in nearly all branches of mining.

Purpose and Scope of Study

This study reviews the major changes in production and employment in the mineral industries since 1929. Its purpose is threefold: (1) To present the index numbers of production, productivity, and employment in the principal extractive industries during the 11-year period 1929-39; (2) to compare the respective trends for the individual industries; and (3) to indicate the more significant factors which appear to have determined these trends.

The index numbers are derived for the seven major industries: Bituminous coal, anthracite, petroleum and natural gas, crushed stone, copper, iron, and lead and zinc. On the basis of the 1929 census of mines and quarries,* these branches account for about 85 percent of the total employment in the extractive industries.

These indexes show that the mineral industries, as a group, were characterized during the 1929-39 period by violent fluctuations in production and employment. This is largely explained by the fact that the greater proportion of output of the extractive in-

* The 1929 census figures were adjusted to include the petroleum and natural gas industry, and enterprises whose value of products was less than $2,500, both of which were not covered by the census.

PRODUCTION, EMPLOYMENT AND PRODUCTIVITY IN THE MAJOR EXTRACTIVE INDUSTRIES IN THE UNITED STATES, 1929-39.

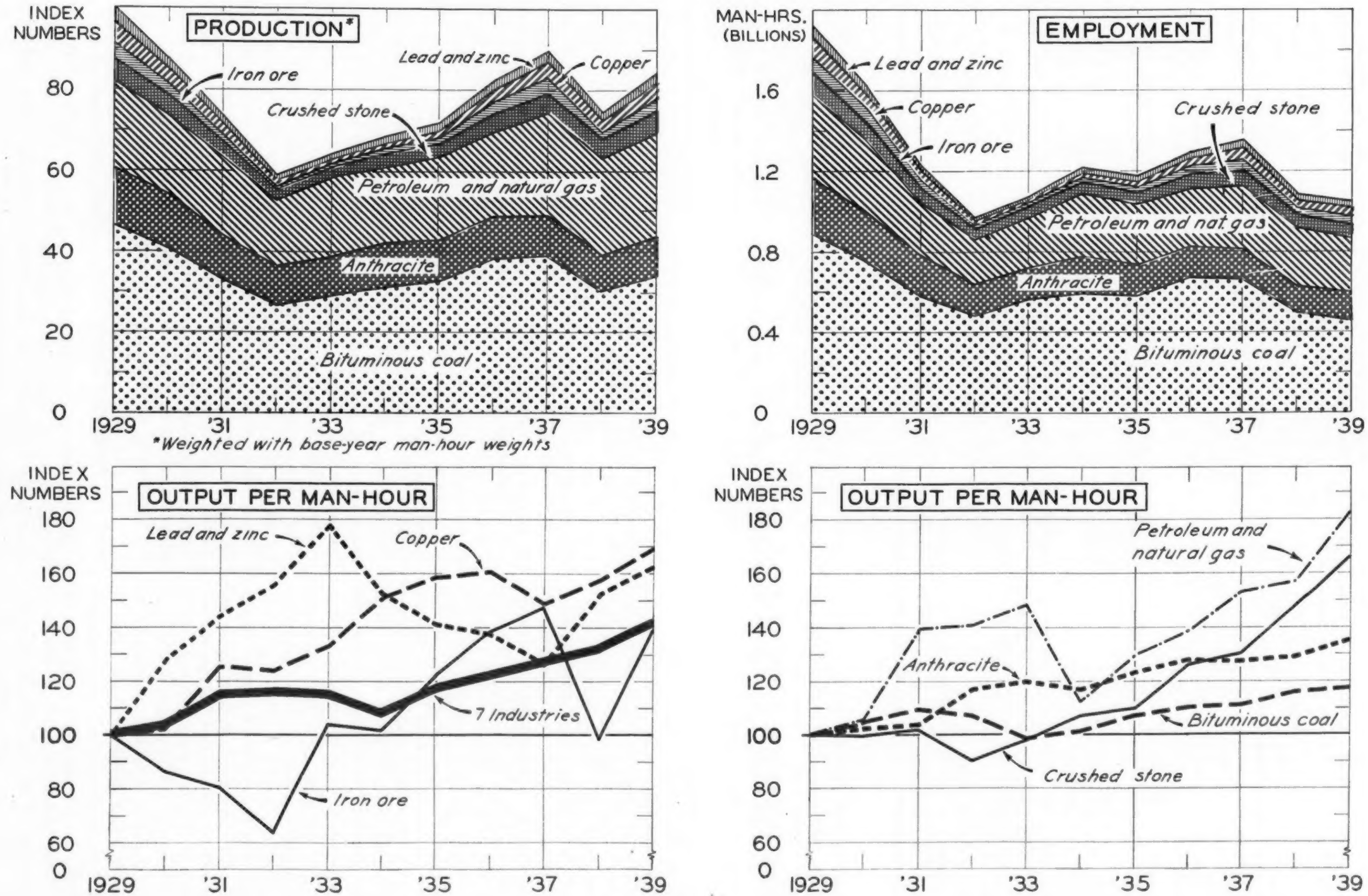


TABLE 1.—INDEX NUMBERS OF PRODUCTION IN THE SEVEN MAJOR EXTRACTIVE INDUSTRIES, 1929-38[1]
(1929-100)

Year	Bituminous coal	Anthracite	Petroleum, natural gas, and natural gasoline [2]	Crushed stone [3]	Copper [4]	Iron ore	Lead and zinc [4]	Total, seven industries [5]
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	87.5	94.0	90.0	88.8	70.6	80.0	84.0	87.7
1931	71.5	76.7	89.7	70.0	53.2	42.6	59.3	73.5
1932	57.9	67.5	75.8	48.3	23.7	13.5	42.1	58.6
1933	62.3	67.2	90.2	47.2	18.8	24.1	47.8	64.1
1934	67.2	77.5	85.3	60.8	23.1	33.6	52.9	68.1
1935	69.7	70.7	94.8	58.3	36.8	41.8	61.8	71.5
1936	82.2	74.0	96.7	88.0	58.5	66.8	69.1	82.3
1937	83.3	70.2	117.0	94.3	80.7	98.7	79.6	89.7
1938	65.1	62.5	110.9	88.4	56.9	38.9	64.7	74.5
1939	73.5	69.7	117.9	104.2	74.3	70.8	72.8	84.1

1 Except where otherwise indicated the figures are based on data reported in the annual volumes of the *Minerals Yearbook* (U. S. Department of the Interior, Bureau of Mines.)
2 Production of the three branches of the industry was combined by totaling the values of the three products, using current prices at the point of production, and dividing this total by the current price of petroleum.
3 For the years 1929-36 inclusive, the data are from Harry S. Kantor and Geoffrey Saeger, *Changes In Technology and Labor Requirements In the Crushed-Stone Industry* (WPA National Research Project In Cooperation with U. S. Department of the Interior, Bureau of Mines, Report No. E-8, Feb., 1939), p. 18.
4 Based on recoverable metal content of ores mined.
5 Obtained by multiplying the composite man-hour index from Table 3 by the composite productivity index from Table 2 (the composite production index so obtained is equivalent to an index whose component indices were weighted with the base-year man-hour weights.)

dustries, with the exception of petroleum, goes into the manufacture of capital and durable-consumer goods, the demand for which is influenced to a far greater extent by changes in business activity than that for nondurable goods. Furthermore, the rapid expansion of these industries during the World War and in the period of prosperity immediately preceding the 1929 collapse has necessitated a greater degree of curtailment than would have been needed if these industries had not been overexpanded. In metal mining, for example, where the expansion was particularly pronounced, production during 1932-33 dropped to the level of the 1880's. Employment in these industries not only responded to curtailment in production but has also been adversely affected by an unusual rise in the output per worker which took place during this period in all of the mineral industries with the sole exception of bituminous coal mining.

This increase in labor efficiency, particularly pronounced in metal mining and in crude petroleum production, was the result of several forces. The declining demand, low prices and intensified competition during the depression became strong incentives to reduce costs by increasing the output per worker. As labor constitutes by far the most important cost item, an increase in the output per man-hour results in a significant, although not a proportional, decrease in the unit cost. In all of the extractive industries this has been brought about largely by mechanization. Moreover, there has been during this period a sharp drop in the number of marginal or less efficient producers virtually in all branches of mining with the exception of small-scale gold producers. In copper mining, for example, there were in 1939 only 47 producing mines as compared with 180 in 1929. In copper and iron ore mining there has been also a steady shift to open-cut operations which are generally characterized by a high output per worker and low unit costs. According to the current release on copper ore by the U. S. Bureau of the Census, the proportion of copper produced from open-cut operations equaled 43 percent in 1939 as compared with an average of 26.5 percent during 1930-32. In iron ore mining, this proportion increased from 57 percent in 1929 to 62 percent in 1939. In crude petroleum production new methods of well drilling and the opening of new wells have been instrumental in raising the output per worker in that industry.

In the present analysis production trends are discussed, first, as production is likely to be the first to feel the impact of economic changes; productivity trends are treated next; and the index numbers of employment are presented last, as employment is largely the function of the other two factors.

Production Trends

An analysis of production indexes reveals that the industries producing the mineral fuels were, on the whole, far less affected by the depression than the industries producing other minerals. As a large proportion of the total fuel output is utilized directly by the consumers, the demand for fuels has fluctuated far less violently than that for minerals used primarily in the manufacture of capital goods.

The petroleum and natural gas (including natural gasoline) industry has fared far better than all others; it has experienced a maximum decline of only 24 percent from the 1929 peak and is the only industry in the group whose 1937 output has exceeded that of 1929. This is largely explained by two factors. First, there has been, despite the depression, a rapid growth of motor and air transportation which together account for by far the greatest portion of the demand for petroleum. About 44 percent of the entire crude petroleum production goes into manufacture of gasoline used chiefly as motor fuel. The domestic demand for such fuel has been increasing steadily, except for a 5 percent drop during 1932-33, until it reached 553,000,000 barrels in 1939.* Of this amount 69 percent was consumed by passenger cars and busses and 20 percent by trucks. Secondly, petroleum and natural gas have become important substitutes for coal, both for home and industrial uses. About 38 percent of the entire crude petroleum goes into production of fuel oils. Of the 408,000,000 barrels of fuel oils consumed in the United States in 1938, only 60,000,000 were consumed by the manufacturing and mining industries.

* *Minerals Yearbook*, 1940 (U. S. Dept. Int. Bur. Mines), p. 992.

The largest proportion, 118,000,000 barrels, was consumed for heating purposes and the remainder for transportation and by power plants. Thus the domestic users and the service industries, which generally also suffer less from economic depressions than those engaged in manufacturing, were responsible for sustaining the consumption of petroleum at a high level with the result that the domestic demand for petroleum has shown a maximum decline of only 11 percent from the 1929 level.† The decline in exports which occurred between 1929 and 1936 has not been particularly significant as the export trade in petroleum constitutes on the average only 12 percent of the total demand. Although there has been a moderate increase in the foreign demand for petroleum since 1936, it was far smaller than anticipated. The effect of the present war on the exportation of petroleum has been so far unimportant. Partly due to the British blockade, partly because of political difficulties, and partly due to lack of dollar exchange, some of the importing countries had to rely on sources other than the United States for their supply of crude oil.

Production of anthracite and bituminous coal has been subjected to two major influences—the contracting demand for coal generally and the wide fluctuations in industrial activity. In anthracite, the decline in demand set in long before the business collapse of 1929 and has been largely the result of price competition with other fuels. With few exceptions, bituminous coal has been available in all localities at prices lower than those for anthracite. The anthracite industry has also been unable to meet petroleum prices. It represents one of the most striking examples of a declining industry. Production of anthracite, having dropped in 1938 to 62.5 percent of the 1929 level, has since shown a maximum recovery of only 7 points.

† *Ibid*, p. 943.

The bituminous coal industry presents a somewhat similar picture. The general decline in demand, which set in shortly after the World War, has been the result of competition with other energy resources; namely, petroleum, natural gas, and water power, and of greater efficiency in the utilization of fuel. Whereas in 1918 bituminous coal supplied 70 percent of the total energy used in the United States, in the last few years it has been supplying only 46 percent.* Since the World War, greater economy in coal consumption has reduced coal requirements per unit of performance by about 35 to 40 percent.† The economic collapse of 1929 tended to depress the production of bituminous coal still further until it touched in 1932 the bottom of 58 percent of the 1929 figure. The upturn was slow and the rate of recovery in production has lagged behind that of most of the other industries. By 1937, bituminous coal output reached 83 percent of that in 1929, only to drop again to 73 percent in 1939.

The non-fuel producing industries have experienced more violent fluctuations in production. Thus, the output of crushed stone declined in 1933 to a low of 47 percent of the 1929 level, but since then has rapidly expanded, reaching 88 per cent in 1936 and 104 percent in 1939. Such rapid recovery in an industry catering almost exclusively to production of capital and durable consumer goods would have been very unusual indeed if it was not for the fact that this industry has benefited probably more than any other from the vast construction programs undertaken by the Federal and State governments.

* *Summary of Findings to Date*, WPA-National Research Project, Philadelphia, Pa., March, 1938, p. 54.

† Based on the data in Table 32, *Minerals Yearbook, 1939*. (U. S. Department of the Interior, Bureau of Mines), p. 807. Figures showing increase in fuel efficiency are weighted by the coal consumed by each industry listed in the table.

Most affected by business reverses have been the metal-mining industries. Production of iron ore declined more precipitously than that of other metals, striking in 1932 the low of 13.5 percent of the 1929 output. However, it has since shown an unusual resiliency in reaching almost 99 percent in 1937, dropping again to 39 percent in 1938, only to recover to 77 percent in 1939. Such wide variations in production are perhaps characteristic of an industry virtually the entire output of which is utilized in the manufacture of capital and durable consumer goods. The amplitude of such fluctuations is magnified in periods of declining price by a rising ratio of production from old scrap to new output. As the cost of production from scrap is generally lower than for new output, the narrowing of profit margins, which usually accompanies low prices, tends to force a relatively greater production of secondary metal and a relatively smaller volume of new output.

Production of copper declined in 1933 to a minimum of 19 percent of the 1929 peak. It has recovered more slowly than iron ore, reaching by 1939 only the 74 percent mark. Like that

TABLE 2.—INDEX NUMBERS OF PRODUCTIVITY IN THE SEVEN MAJOR EXTRACTIVE INDUSTRIES, 1929-38[1]
(1929-100)

Year	Bituminous coal	Anthracite	Petroleum, natural gas, and natural gasoline	Crushed stone	Copper	Iron ore	Lead and zinc	Total, seven industries[2]
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	104.4	102.3	105.4	99.8	102.6	86.1	128.2	103.7
1931	109.5	103.2	139.3	101.6	125.8	80.4	144.3	114.7
1932	107.4	117.0	140.4	90.4	124.1	63.4	155.9	116.0
1933	98.6	120.0	148.6	98.3	133.3	103.9	177.0	115.2
1934	101.0	116.5	112.2	107.0	151.0	101.5	152.4	108.0
1935	106.8	123.0	129.3	110.0	158.0	122.6	141.4	117.1
1936	109.9	128.2	138.7	126.3	160.7	138.6	137.9	122.4
1937	111.4	127.4	153.1	130.2	148.9	148.0	126.6	127.3
1938	116.0	128.9	156.9	148.6	157.6	98.0	152.6	132.3
1939	117.6	135.1	182.8	165.9	169.2	139.9	162.1	141.6

1 Computed by dividing the index numbers of production by the index numbers of man-hours of employment. (See Table 1 for production data, and Table 3 for employment data.)
2 Weighted with the man-hours of employment in current years in the respective industries.

of iron, it is greatly affected by the demand for capital and durable consumer goods, as well as by the recovery of copper from old scrap.* More than that of any other mineral commodity, production of copper has been influenced by foreign market conditions. In the period immediately preceding the present war this influence, however, had been steadily diminishing, first, because of the rapidly growing competition of low-cost African and Canadian copper which had been displacing the American metal in the European markets, and secondly, because of a 4-cents-per-pound tariff barrier which prevented foreign copper from entering the domestic market. Since the beginning of 1937, however, in the anticipation of war, the demand for the American copper rose sharply. The exports of copper during 1937 increased by 35 percent over those in the previous year. This trend has since continued, and the exports of copper in 1939 reached 920,000,000 lbs., compared with 574,000,000 lbs. in 1936 and 810,000,000 in 1929.** The excess of total exports over imports amounted to about 400,000,000 lbs. in 1938 and 246,000,000 lbs. in 1939, or 36 and 17 percent of the total domestic output, respectively, in the two years. The exports of copper during 1940 are estimated to have exceeded only slightly those in 1939, although the three largest purchasers—Japan, Great Britain, and Russia—imported in the first 11 months of 1940 about 472,000,000 lbs., compared with only 340,000,000 lbs. during all of 1939.†

The year 1940 witnessed a further growth in copper production which the U. S. Bureau of Mines estimates at 1,814,000,000 lbs., an increase of 25 percent over 1939, and only 9 percent below the 1929 peak. Perhaps, of particular significance is the fact that this increase in copper output was accomplished with no corresponding increase in copper prices, which throughout 1940 remained below 12 cents per pound, although during November and December of 1939 the price stood at 12.275 cents.

In the anticipation of a growing foreign demand for the American copper and in order to insure a sufficient supply of this metal for defense needs, copper was placed by the Presidential Proclamation of January 10, 1940, under export license control. It appears, however, that the annual capacity of the copper industry is sufficient, at least for the present, to meet the additional demand. The practicable annual capacity of copper mines and mills is estimated by the author at 1,250,000 short tons of copper, or 25 percent above the 1929 peak. On this basis, copper mines and mills operated during 1940 at only about 73 percent of their attainable capacity. It is believed that the estimated capacity can be reached with the existing plant facilities and with no significant increase in the price of copper over the level which prevailed in 1940.

Of the metal mining industries, lead and zinc mining has suffered least. To some extent this is accounted for by the lesser dependence of this industry upon foreign markets than in the case of either copper or iron ore. Exports of zinc until 1940 had been negligible, and the export trade in lead has been, for the most part, under 8 percent of the total domestic production. Furthermore, about 50 percent of lead output is utilized in the manufacture of storage batteries and white and red lead, the consumption of which was sustained at a relatively high level throughout the depression. As for zinc, over 40 percent of the total production is utilized in galvanizing, the demand for which, although reduced in 1932 by more than 60 percent from the 1929 figure, was proportionately greater than that for either copper or iron ore. The decline in production was greatest in 1932 when the output of lead and zinc equaled 42 percent of that during 1929.

The year 1940 witnessed, however, an unusual spurt in the foreign demand for the American zinc reminiscent of the World War days and the boom export years of 1924-25. From less than 6,000 short tons of refined zinc in 1938, the exports first increased to about 11,000 tons in 1939 only to rise suddenly to 82,000 tons in 1940, according to the figures recently released by the U. S. Bureau of Mines. Such growth in the demand for zinc from abroad, coupled with the limited reserves of zinc ores in the United States, prompted the placing of zinc, simultaneously with copper, under export license control. The output of zinc from the domestic ores in 1940 is estimated by the U. S. Bureau of Mines at 589,000 short tons, compared with 491,000 tons in 1939 and 612,000 tons in the peak year of 1929. This sudden and very pronounced increase in the demand for zinc was reflected in its price, which rose from an average of 5.1 cents per pound in 1939 to 7.25 cents in September, 1940, at which level it was then stabilized.

The rapidly growing consumption requirements for zinc have raised the question as to whether the zinc industry can meet such a demand. The author estimates the practicable capacity of the domestic industry—that is, the output of zinc from newly mined domestic ores—in the neighborhood of 850,000 short tons, or 40 percent above the 1929 peak. It is believed that this output can be attained with the existing plant facilities and at a price of zinc essentially equal or only slightly higher than that which prevailed at the end of 1940.

Production of lead from the domestic ores has undergone but few changes during 1940. The output of lead from such ores is estimated by the U. S. Bureau of Mines at 458,000 short tons, only a 9 percent increase over the 1939 figures. Exports of refined lead in the first 11 months of 1940 equaled 22,800 short tons, compared with 74,000 tons during all of 1939. The most significant development in the lead industry during 1940 was a sudden and an unprecedently high increase in the importation of refined lead which, according to the U. S. Bureau of Foreign and Domestic Commerce, amounted to 141,000 tons during the first 11 months of 1940, compared with only 5,400 tons in 1939 and exceeding four times the previous high of 35,000 tons in 1920. The increasing domestic requirements, on the one hand, and availability of large quantities of lead in Mexico and to a lesser extent in some South American countries due to the shutting off of the European markets by the British blockade, on the other, led to a large increase in the United States imports of refined lead. This fact was undoubtedly responsible for preventing an increase in price which during 1940 remained at a level only slightly above that in 1939.

The composite production index for all industries shows a maximum decline of 41 percent from the 1929 level. The index, however, is very heavily weighted with the three fuel-producing industries which have been least affected by the 1929 depression.

---

* Copper produced from old scrap equaled 40.5 percent of the domestic mine output in 1929, 36.5 percent in 1933, and 48.5 percent in 1937. The average domestic price of copper during these years was respectively 18.1, 7.0, and 13.2 cents per pound f.o.b. refinery. Sources: Annual volumes of *Minerals Yearbook*, U. S. Bureau of Mines.

** Yearbook of the American Bureau of Metal Statistics, 1939, p. 35.

† U. S. Bureau of Mines Preliminary Release, January 7, 1941.

Rising Output Per Worker Employed

An analysis of productivity indexes reveals a number of interesting facts. In the bituminous coal industry, which accounts for 45 to 50 percent of the total employment in the industries included in the sample, there was between 1929 and 1931 a rather sudden rise of about 10 percent in the output per man. The method of wage payment coupled with the conditions under which the coal industry operated during this period undoubtedly was responsible, at least in part, for this increase. In periods of curtailed demand, mine owners usually operate only a limited number of days per month. As most of the coal miners are paid by the ton, and with their income limited by the number of work days available, they are impelled to increase their daily output in order to earn enough for the entire month. This fact tended to raise the output per worker in the two years that followed the 1929 collapse, when the number of days worked decreased from 219 in 1929 to 160 in 1931. During the remaining portion of the 1929-39 period the output per man fluctuated but never exceeded the 1929 level by more than 18 percent.* It is also highly probable that, like in so many other extractive industries, the volume of development work has been greatly reduced since the onset of the depression, and a number of less efficient mines have been forced out of business by low prices and curtailed market.

The anthracite industry, on the other hand, showed a steadily rising output per worker between 1929 and 1939, output in 1939 exceeding that in 1929 by 35 percent. Since the onset of the depression, selective mining—that is, confining the operations to the more productive mines and extracting anthracite from the more productive beds—has been resorted to on an increasing scale. The mining of anthracite lends itself particularly well to this practice, as most of the anthracite deposits occur in beds of various thickness, thus for a time permitting the concentration of operation at any one bed. It is also highly probable that the larger operators have confined the extraction of coal, as far as practicable, to reserves that are readily accessible, deferring any major development and avoiding the labor-consuming tasks in broken ground.*

The petroleum and natural gas industry showed an almost 60 percent rise in the output per worker during the 1929-38 decade. In 1939 the output per man-hour was 83 percent

* From figures quoted in *Coal Mine Mechanization*, 1940, p. 321.

* *Summary of Findings, op. cit., p. 49.*

TABLE 3.—MAN-HOURS AND INDEX NUMBER OF EMPLOYMENT IN THE SEVEN MAJOR EXTRACTIVE INDUSTRIES, 1929-38

Year	Bituminous Coal 1	Anthracite 2	Petroleum Natural Gas, and Natural Gasoline 3	Crushed Stone 4	Copper 5	Iron Ore 6	Lead and Zinc 7	Total, Seven Industries
			Man-Hours of Employment (Millions)					
1929	891.8	272.0	413.3	104.2	95.9	77.1	62.3	1,916.6
1930	747.0	250.0	353.0	92.7	66.0	71.6	40.8	1,621.1
1931	582.4	202.0	266.0	71.8	40.6	40.9	25.6	1,229.3
1932	481.0	157.0	223.0	55.6	18.3	16.4	16.8	968.1
1933	563.8	152.3	251.0	50.0	13.5	17.9	16.8	1,065.3
1934	594.1	181.0	314.0	59.2	14.7	25.5	21.6	1,210.1
1935	581.3	156.3	303.0	55.2	22.3	26.3	27.2	1,171.6
1936	667.5	157.0	288.1	72.6	34.9	37.2	31.2	1,288.5
1937	667.0	149.8	315.9	75.4	52.0	51.4	39.2	1,350.7
1938	500.7	131.9	292.3	62.0	34.6	30.6	26.4	1,078.5
1939	557.6	140.4	266.7	65.4	42.1	39.0	28.0	1,139.2
			Index Numbers (1929-100)					
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	83.8	91.9	85.4	89.0	68.8	92.9	65.5	84.6
1931	65.3	74.3	64.4	68.9	42.3	53.0	41.1	64.1
1932	53.9	57.7	54.0	53.4	19.1	21.3	27.0	50.5
1933	63.2	56.0	60.7	48.0	14.1	23.2	27.0	55.6
1934	66.6	66.5	76.0	56.8	15.3	33.1	34.7	63.1
1935	65.2	57.5	73.3	53.0	23.3	34.1	43.7	61.1
1936	74.8	57.7	69.7	69.7	36.4	48.2	50.1	67.2
1937	74.8	55.1	76.4	72.4	54.2	66.7	62.9	70.5
1938	56.1	48.5	70.7	59.5	36.1	39.7	42.4	56.3
1939	62.5	51.6	64.5	62.8	43.9	50.6	44.9	59.4

1 Data for the years 1929-36 are from Willard E. Hotchkiss, F. G. Tryon, and others, *Mechanization, Employment, and Output Per Man In Bituminous-Coal Mining* (WPA National Research Project in cooperation with U. S. Department of the Interior, Bureau of Mines, Report No. E-9, Aug., 1939), II, p. 358; for 1937 and 1938 the number of man-days reported in *Minerals Yearbook* (U. S. Dept. Int., Bur. Mines), 1939 vol. p. 790, and 1940 vol. p. 776, respectively, for the two years, and for 1939 reported in the U. S. Bureau of Mines preliminary release, was multiplied by 7.02 hours which was the average length of working day during 1935 and 1936.

2 Man-hours obtained by multiplying the average number of men employed by the average number of days worked, as reported in annual volumes of the *Minerals Yearbook* and the result multiplied by eight hours which is the predominant length of working day at anthracite mines.

3 Data for 1929, 1936, and 1937 are from O. E. Kiessling, H. O. Rogers, and others, *Technology, Employment, and Output Per Man In Petroleum and Natural-Gas Production* (WPA National Research Project in cooperation with U. S. Department of the Interior, Bureau of Mines, Report No. E-10, July 1939), p. 327; for 1930-35 and 1938-39, the man-hours of employment were obtained by extrapolating the 1936-37 average on the basis of the U. S. Bureau of Labor Statistics index of employment in crude-petroleum production.

4 Data for the years 1929-36 are from Harry S. Kantor and Geoffrey A. Saeger, *Changes In Technology and Labor Requirements In the Crushed-Stone Industry* (WPA National Research Project in cooperation with U. S. Department of the Interior, Bureau of Mines, Report No. E-8, Feb., 1939), p. 18. Data for 1937, 1938 and 1939 are obtained by extrapolating the 1936 figures on the basis of the U. S. Bureau of Labor Statistics index of employment in "quarrying and non-metallic mining."

5 Data are from annual reports of *Metal-Mine Accidents In the United States* (U. S. Dept. Int., Bur. Mines). The figures do not include employment at ore-dressing plants.

6 Data are from the *Minerals Yearbook*, 1937, p. 600; 1938, p. 506; and 1939, p. 556; 1940, p. 550.

7 Data for 1929-37 are based on the statistics contained in *Production, Employment and Output per Man in Lead and Zinc Mining*, a report to be published by the W.P.A. National Research Project and the U. S. Bureau of Mines; data for 1938 and 1939 are obtained by extrapolating the 1937 figures on the basis of production and employment data reported by the U. S. Bureau of Mines for the Mississippi Valley Region for 1938 and 1939.

above the 1929 level. This increase has been largely brought about by technological improvements generally and by the advances made in well-drilling techniques in particular. The ability of the industry to tap new wells has likewise contributed to the higher output per man.†

Labor productivity in the crushed stone industry was virtually constant between 1929 and 1934. Since then, it has exhibited a steady increase, attaining in 1939 a peak of 66 percent above the 1929 level. Improvements in mechanization and greater efficiency in the utilization of productive capacity, which accompanied the rise in production, have been primarily responsible for this increase.

Among the metal-mining industries, probably the most remarkable progress has been attained in copper, where the output per worker in 1939 exceeded that in 1929 by almost 70 percent. This rise in labor productivity has been largely brought about by greater technological efficiency and by an increasing proportion of copper ore mined by the open-cut method.

There has been also a very marked increase in the productivity of lead and zinc mining. In the depression years, 1932-33, the output of metal per man was unusually high, exceeding that of 1929 by almost 80 percent. This, however, was a temporary phenomenon largely attributable to selective mining and to reduction of development work to a minimum. The average net gain has remained, however, at about 40 percent over the 1929 level.

The productivity trend in iron ore mining has been the most peculiar of all the industries. At first, the output per worker was steadily declining until in 1932 it approached 63 percent of the 1929 figure. Then it began gradually to rise, attaining in 1937 a peak of 148 percent of the 1929 level, dropped to 99 percent in 1938, only to rise again to 140 percent in 1939. As revealed by a comparison of production and productivity indexes, the output per worker in iron mining, perhaps more than in any other industry, is a function of the proportion of productive capacity utilized.

The effect of changing productivity on employment in all extractive industries is indicated by the composite index weighted by the total man-hours of labor expended. Except for the four years 1936-39, the increase in the output per worker has not exceeded the 1929 mark by more than 17 percent. The maximum was reached in 1939 when it was 41.6 percent above that in 1929. The effect of including the bituminous coal industry, where the increase in productivity has been relatively small, is very pronounced, and the figure for the output per worker would have been materially higher had bituminous coal been excluded from the composite index.

† *Op. cit.*, p. 63.

Downward Trend of Employment

The effects of changing productivity and fluctuations in production are ultimately shown in the changes in the volume of employment as measured by the total man-hours of labor expended. The decline in employment in the period immediately following the 1929 crash has been generally less pronounced in the fuel-producing than in the non-fuel producing industries. In coal mining this has been largely due to the fact that the increase of the output per worker has not been as great as in most of the other industries, while in the petroleum and natural gas industry the relatively large volume of production has helped to maintain employment at a relatively high level despite the rapid increase in the output per man. The total net gains in employment from the 1932-33 low, however, have been proportionately smaller in coal mining than in most of the other extractive industries.

In the bituminous coal industry the lowest employment level was reached in 1932, when it equaled 53.9 percent of that in 1929. Subsequently, however, employment has recovered, attaining a maximum of 74.8 percent in 1936, only to drop to 62 percent in 1939.

In anthracite the situation has been somewhat different. The bottom was struck in 1933, when the man-hours of employment dropped to 56 percent of the 1929 figure and, with the exception of 1934, when a 10 percent gain was made, employment remained at essentially the same level during the rest of the 1929-39 period.

The employment trend in the petroleum industry has been very much the same as that in bituminous coal, although for the entirely different reasons as indicated above. The volume of employment first dropped to 54 percent in 1932, then rose to 76.4 percent in 1937, but has subsequently declined to 64.5 percent in 1939.*

Changes in employment in the crushed stone industry have been also quite similar to those in bituminous coal. Employment dropped lower, however, than in coal—to 48 percent in 1933—and on the upward trend has reached only 72 percent in 1937.

* The figures for 1930-35 are estimates and should be used with reservation.

The most severe reductions in man-hours of employment have occurred in the metal mining industries. Not only did employment decline more than in other industries, but it has also failed to recover as much ground. Copper mining suffered most severely, employment having dropped in 1933 to 14 percent of the 1929 level. Recovery was very slow and, with the exception of 1937 and 1939, when the index stood at 54 and 44 percent, respectively, for the two years, employment has been under 37 percent of the 1929 figure. This situation has developed both because of the failure to make sufficient gains in the volume of production (except during 1937 and 1939) and because of an unusually high increase in the output per worker.

A similar situation has existed in iron ore mining, where the employment index dropped in 1932 to 21 percent. On the upturn, with the production index at 67, the employment index reached 48 percent in 1936 and 66.7 percent in 1937, when production virtually equaled that of 1929. In 1939 employment dropped to 50 percent of the 1929 mark.

The employment trend in lead and zinc mining has paralleled rather closely that in iron ore. The ebb of 27 percent was reached in 1932-33, with a subsequent rise to 63 percent in 1937 and a decline to 45 percent of the 1929 level in 1939.

The composite index of employment for the seven extractive industries declined in 1932 to almost exactly one-half of the 1929 volume, and in 1939, with the production index at 84, it stood at 59 percent of the 1929 level.

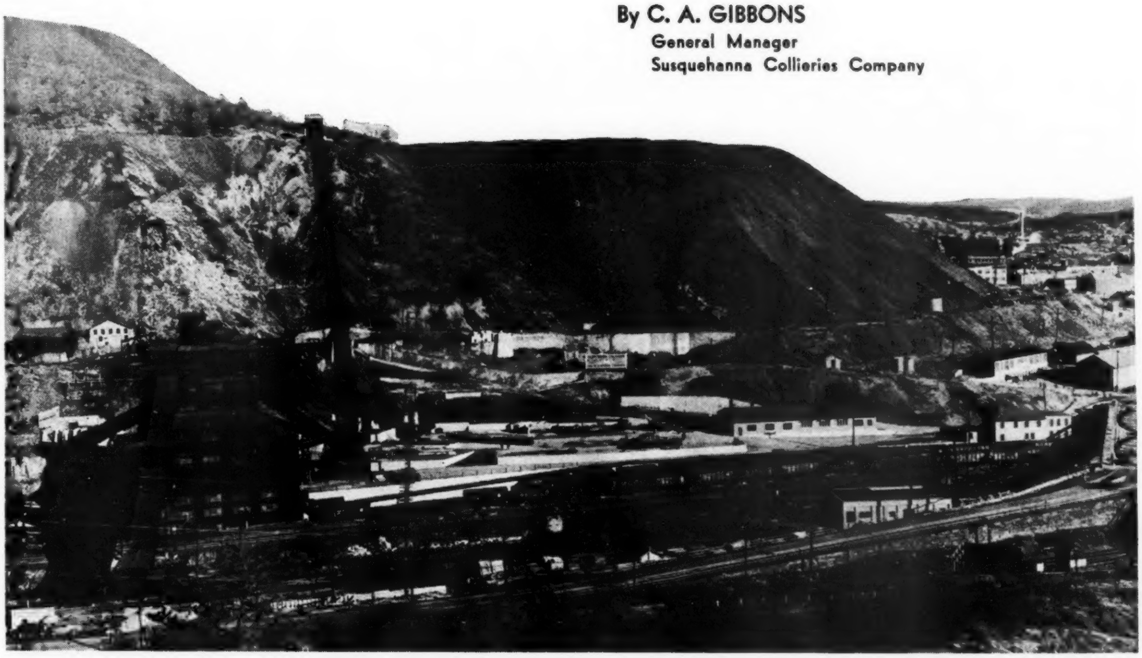
American Metal of New Mexico Starts Work at Republic

A carload of machinery, including a diamond drill, has been shipped by the American Metal Co. of New Mexico, Tererro, N. Mex., to the Republic mine in the Russellville-Johnson area near Dragoon, Ariz. J. T. Matson, general manager of American Metal; John Payne, engineer, and Jess Humphries, diamond driller, are at the Republic and adjoining claims, supervising the work. The properties contain values in copper principally. A crew of men has been employed on the ground for some time.

THE NEW GLEN BURN COLLIERY—

Susquehanna Collieries Company

By C. A. GIBBONS
General Manager
Susquehanna Collieries Company



General view of the Glen Burn Plant. Breaker at left, refuse plane and mine dump in the rear

THE Anthracite Industry has been facing for a number of years now, a highly competitive market not only within itself, but with the numerous competing fuels. This competition in the industry, in conjunction with the fact that at the mines the workings each year are extending in area, thereby increasing the costs of transportation, ventilation and drainage, results in presenting the mine operator with an increasingly perplexing problem to produce a first-rate satisfactory anthracite fuel product, with economy of operation.

In the Western Middle Anthracite Field, after years of management and engineering studies, the Susquehanna Collieries Company's answer to these problems is their new Glen Burn Colliery at Shamokin, Pa.

History of the Area

The original colliery or opening in the area now comprising Glen Burn Colliery was started over one hundred years ago, anthracite coal being extracted from a small hillside drift in the year 1836. The coal from this drift was transported by a team and wagon to Sunbury, from where the coal was shipped southward to market by boats on the original Susquehanna River Canal.

Mining continued in this manner spasmodically for a number of years until finally the first breaker or tipple was constructed in 1857, which was only a small hand picked mine-run cleaner. The first consolidation of coal lands in these areas occurred during the years following the Civil War and specifically in the year 1871, when the predecessor in title to the Susquehanna Collieries Company consolidated and acquired large areas of the coal lands and from that year to the present, mining of anthracite coal on a regular commercial scale in the Glen Burn area has been an accomplished fact.

At one time the Susquehanna Company had in operation four large breakers on these tracts of land, the tonnage of which is now all blended and consolidated in the modern Glen Burn Breaker.

Geology and Mining Methods

The lands of the Susquehanna Company in the Western Middle Field lie between the towns of Mount Carmel on the east and extend three miles westward beyond the town of Shamokin on the west, with a width of approximately one mile.

There are fifteen mineable veins, some of which appear twice in the geological cross section, with a total average thickness of 89 feet 2 inches of coal in all veins. These range in thickness from the No. 13 Vein which is 2 feet 6 inches to the No. 9 Vein which is 18 feet thick, from the top slate to the bottom slate. The veins outcrop on the surface at elevation from 950 to 1,358 feet above sea level and basin at an elevation of 900

feet below sea level, although the lowest present workings is only at an elevation of minus 320. A major fault runs the length of the property. On the north of this fault the pitch of the veins is regular and averages 48 degrees while on the south side of the fault the veins pitch on an average of 75 degrees. This fault causes the same vein to appear twice on a mining level. Development plans for the future can thus be carried out successfully, as the veins have both regular pitch and thickness. The strata between the veins are composed of sandstones and sandslates of varying hardness while in the Lykens Valley, or lower measures, conglomerate strata predominate.

A cross section showing the general relationship of the veins is noted in the accompanying illustration.

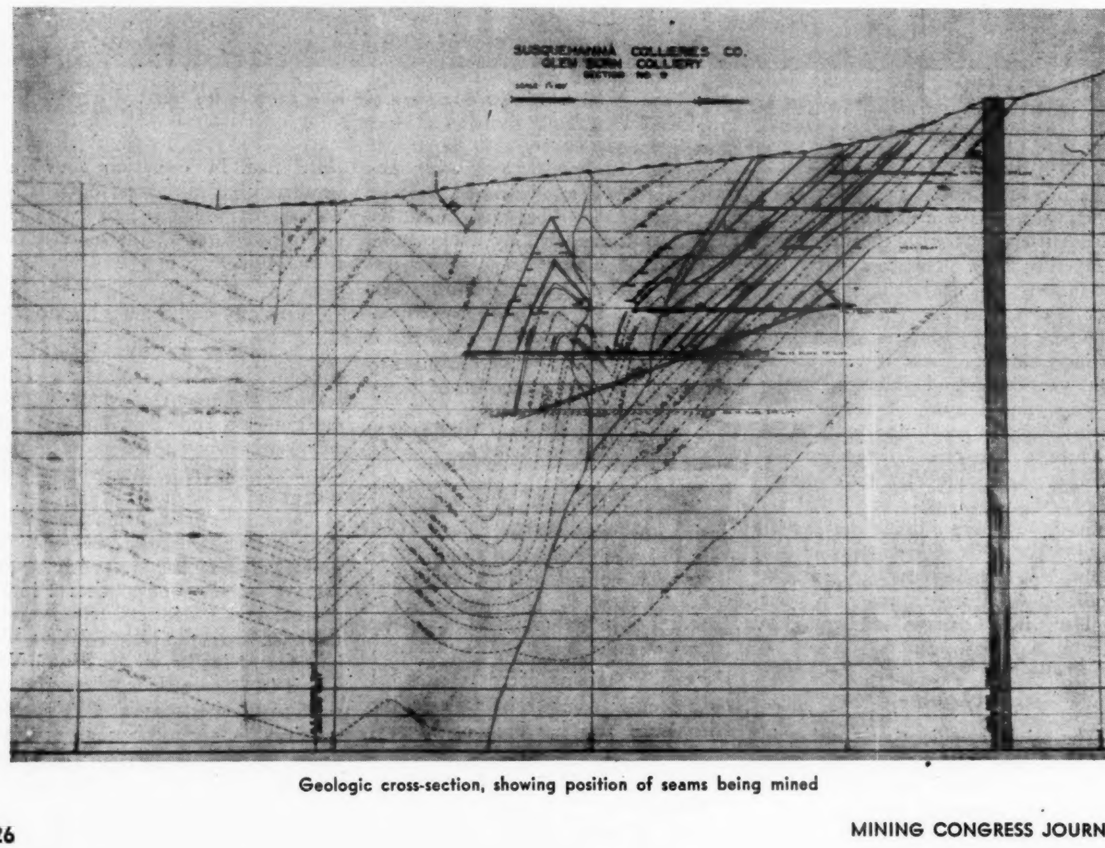
A large percentage of the coal prepared at Glen Burn Breaker is delivered in mine cars from sections known as the West Drift and No. 1 Slope. The coal from the West Drift is loaded in the mine into 110-cubic foot mine cars and drawn to the surface by electric haulage locomotives. On the surface these cars are emptied by a rotary dump into a 48-inch conveyor line 200 feet long which carries the coal to the picking table in the breaker. From No. 1 Slope the coal is hoisted in 115-cubic foot mine cars up a slope on a pitch of 39 degrees and 560 feet in length. At the top of this slope the coal from the car is dropped into a 48-inch conveyor line 170 feet long which carries the coal to the picking table in the breaker.

In the West Drift the coal is gathered at two central points, one at the bottom of the No. 4 Vein Plane and the other at No. 180 Tunnel. In the No. 1 Slope Level the gathering point is at No. 12 Slope top and at No. 169 Tunnel. Regular schedules are maintained on these two haulage roads. All rail consists of 60-pound sections on the haulage roads and is well bonded. The West Drift haulage is 13,500 feet in length and the No. 1 Slope haulage which for a distance consists of parallel gangways, has a track system of 25,000 feet.

A plane has been driven in the West Drift 7,500 feet from the portal. This plane was driven in the No. 4 Vein across the pitch on 27 degrees. At regular intervals, to divide the lift between the drift level and the surface, two landings were driven and tunnels extended to the uppermost vein on these levels, to give a lift from which a breast can be worked. On the No. 1 Slope Level a slope has been driven downward at 20 degrees for a distance of 1,190 feet, to mine the coal below the No. 1 Slope Level. Two lifts have also been driven off this slope dividing the distance between the lower lift and the No. 1 Slope Level.

On each level or lift the haulage road is being driven in No. 4 Vein or lowest vein in the strata now being mined. At regular intervals off this vein tunnels are driven south to the topmost vein. The development plan is thus to drive tunnels in turn so as to sectionalize the entire property, as the uppermost vein being worked off a sectional tunnel has reached a predetermined point and the robbing of the vein has started. At this time the next sectional tunnel inside has been completed and mining has been started. This, of course, holds true of the other veins cut by the tunnels.

As the veins at Glen Burn mine pitch on 48 and 75 degrees, the conventional breast and pillar system is used. In this method the gangways are driven first, practically all of



Geologic cross-section, showing position of seams being mined

which are timbered with three-piece sets. These sets are spaced $5\frac{1}{2}$ feet apart. The set consists of a collar with $6\frac{1}{2}$ feet between notches and legs on both sides so that the collar is 7 feet clear from the rail to the underside of the collar and 11 feet in the clear between the legs at the rail. The chutes are driven on 50-foot centers and are made 10 feet wide for a distance of 24 feet at which point the monkey heading is driven. As the gangway advances the ventilation is carried in the gangways and up the chutes to the monkey heading, thence back through the breasts. The breast is then driven at right angles to the strike of the vein. The breast is an average of 24 feet in width. It is necessary to carry a manway on each side of the breast 3 feet in width. Props or couplings are placed every 4 to 6 feet on which brattice boards are nailed, forming a box into which the coal is dropped as it is mined from the face. The excess coal is loaded from the chute at the gangway into the mine car. As the breast advances headings are driven every 60 feet to the outside breast, establishing ventilation.

After a gangway has reached its specified limit, the pillars are removed. A pillar hole or chute 8 feet in width is driven off the gangway in the center of the pillar. This is advanced in the same manner as the breast, with manways on both sides of the gob box. When the pillar hole has advanced to the same height as the face of the outside breast the remaining pillars on both sides are then shot off and loaded out of the pillar hole on the gangway.

Other Mine Openings

Run of mine coal is also transported by railroad car for preparation from the following locations:

Hickory Swamp No. 5 Slope: This coal is hoisted up a slope 320 feet in length and dumped into a tipple from which the coal is carried on a belt conveyor 250 feet long, to the railroad car. The mining at Hickory Swamp is being carried on in practically the same manner as at the Glen Burn mines, although, on the flat pitch in the No. 5 Vein a number of shaker conveyors are used to bring the coal to the gangways for loading into mine cars.

Hickory Ridge No. 9 Slope: Here the coal is hoisted up a slope and dumped into a tipple and then into the railroad cars. At this mine a slant method is being followed of working breasts across the pitch, the pitch of the vein on one side of the basin being 48 degrees and on the other side 75 degrees. The breasts are worked across the pitch on 25 degrees and pillars removed immediately down to a point 60 feet above the gangway. This method eliminates the breakage of any topslate, which otherwise would fall and mix with the coal if the breast were to stand for a period of time.

Pennsylvania Section: The coal is hoisted up 4 different slopes and dumped into tipples, from which it is loaded into auto trucks and transported to a railroad siding where it is placed in railroad cars. Mining at these slopes is carried on in the same manner as at Glen Burn Section.

Coal is being mined from the following slopes and transported to Glen Burn Breaker by mine car or railroad car.

As Much as 16 Tons of Water Pumped per Ton of Coal Mined

Since a great quantity of water finds it way to the underground workings it is necessary that provision be made to conduct this water to the surface. In the gangways and tunnels a ditch is carried on the low side approximately 2 feet wide and 1 foot below the top of the sill. This water is conducted to a sump at the bottom of No. 1 Slope which has been driven at a lower elevation than the gangway level. From this sump the water is pumped to the surface by eight pumps, ranging in size from 6 to 10 inches and from 2 to 4 stages, having a vertical lift of 278 feet to the surface and of 348 feet to the breaker; the possible output is 15,000 gallons per minute. The water for coal cleaning is pumped to the breaker from the mines. For the year 1940 it is estimated that 16 tons of water were

MINE	SLOPE	LENGTH OF PITCH	PITCH	VEIN	REMARKS
Glen Burn	#4 Vein Plane	675′	27 degrees	#4 Vein	Inside
Glen Burn	#1 Slope	560′	39 degrees	#9 Vein	Surface
Glen Burn	#12 Slope	1190′	20 degrees	Rock	Inside
Hickory Swamp	#5 Slope	700′	25 degrees	Rock	Surface
Hickory Swamp	#5 Vein Plane	2100′	12 degrees	#5 Vein	Inside
Hickory Ridge	#9 Slope	560′	33 degrees	#9½ Vein	Surface
Pennsylvania	#5 Slope	530′	30 degrees	#9 Vein	Surface
Pennsylvania	#17 Slope	611′	32 degrees	#9 Vein	Surface
Pennsylvania	#18 Slope	475′	44 degrees	#9 Vein	Surface
Pennsylvania	#21 Slope	400′	26 degrees	#8 Vein	Surface

No. 1 Pumping Station

pumped to the surface for every ton of coal mined.

The type of installed pumping station is illustrated herewith.

Power

The Collieries Company purchases electric power from the Pennsylvania Power and Light Company, who maintains and operates a large power plant in the vicinity of Mt. Carmel, known as the Kulpmont-Steam-Electric Station. Power is transmitted at 23 KV to two substations, one of which is located at Hickory Swamp, five miles west of the power plant, and the other seven miles west of the plant at Glen Burn Colliery. The transmission lines and substations convert the 23 KV current to 2.3 KV and to 230 volt direct current. From these two substations the power is distributed to the various parts of the colliery, both inside and outside. Equipment in the mines and on the surface has been completely electrified.

Safety Program an Important Part

A monthly safety meeting is held in the Glen Burn Colliery, under the direction of the superintendent. All foremen and supervisors attend and all accidents are thoroughly analyzed to determine the cause and method of prevention. A colliery safety inspector who reports directly to the supervisor of safety and compensation under the general manager, makes daily visits to various parts of the mines and surface locations, after which the inspector makes a report of criticisms and recommendations noted during the days' travel.

Six first aid teams are maintained at the various sections who are trained by the company surgeons, and contests are held from time to time. Emergency hospitals are maintained both in the mines and on the surface to care for any injuries.

A mine rescue squad certified by the United States Bureau of Mines is maintained and a monthly training held, at which time new men are continually being trained under a certified instructor and the safety inspector, who is a certified helmetman. This rescue equipment consists of McCaa oxygen helmets and Burrell gas masks which are ready at any time for any emergency. Training is also given on an H-H inhalator for resuscitation of victims involving respiratory failure. Equipment for testing for carbon monoxide and methane gas is also maintained at this rescue station.

Breaker is Modern and Efficient

The coal preparation plant is housed in a modern steel frame building 95 feet wide, 100 feet long and 105 feet high, sheathed with corrugated asbestos protected metal. The floors, stairways and coal pocket linings are timber construction and the chutes and shaker hoppers are constructed of angle iron and sheet steel.

The raw coal is fed into the breaker by means of three main conveyors each consisting of two strands of 9" pitch link and pin conveyor chain with 12" high by 42" wide sheet steel flights spaced every 54". On the east side of the breaker is the head of No. 1 Slope; the mine cars from this slope are emptied into a hopper and the material fed into Conveyor No. 1 by means of a push feeder, being conveyed a distance of 165 feet with a rise of 2 3/16" per foot. At this point by the use of an air controlled lift gate which forms a separate chute over the coal hopper, mine rock is dumped into a separate chute leading directly to the refuse pocket; this dumping point is so located in elevation that the rock flows into the pocket by gravity, the chute having a pitch of 6" per foot.

On the west side of the breaker is the mouth of the West Drift; the mine cars from this opening are emptied by means of a rotary car dump into No. 2 Conveyor which carries the material a distance of 200 feet with a rise of 7⅜" per foot. At a midway point No. 2 Conveyor is intersected by No. 3 Conveyor which carries the material from the 50-ton railroad cars secured from the various other openings of the property. This conveyor is also the lip line of the breaker. These three conveyors are all separately controlled and the material can be fed or blended into the breaker as desired. The length of this No. 3 Conveyor is 125 feet with a rise of 7⅛" per foot. The No. 1 and No. 2 Conveyors discharge into a common hopper at the head of the breaker. Underneath this hopper is a set of three shakers known as the "Bull" shakers. The top one is dressed with 4¾" diameter mesh, the material passing over this shaker being known as lump and steamboat size; this material is fed evenly onto a shaking table where all the rock and slate are removed manually and chuted to the refuse pocket, the pure coal passing through the No. 1 Rolls being ground to broken (4¾" x 3¼") and smaller. The material passing through the top "Bull" shaker, known as counter coal, is separated on the second shaker to broken (4¾" x 3¼"), egg (3¼" x 2 7/16") and stove (2 7/16" x 1⅝"). The material passing through the second shaker is sized on the third shaker to nut (1⅝" x 13/16" and pea 13/16" x 9/16"). The material passing through the third shaker is caught in a hopper and chuted to the fine coal feed shakers. After passing through the No. 1 Rolls the coal converges with the counter coal on the domestic feed shakers from whence it is chuted to the 15'-0" diameter chance cone. All material passing through the bottom domestic feed shaker is chuted from a hopper to the fine coal shakers. The chance cone uses as a separating medium a mixture of sand and water at a gravity of 1.65 and maintained in a fluid state by means of a rotating agitator; this gravity is constantly checked by weighted balls and maintained by the addition of either sand or water as needed. The material is fed into the top of the fluid mass, the coal floating at or near its top and overflowing onto the domestic desanding shakers. This is a set of two shakers, the top one sizing out the broken and larger sizes discharging into the No. 2 Rolls which are set to crush to egg size with a small percentage of broken. The second screen of this set, on the back end, removes all the sand and water to a hopper where it is chuted to the 10' fine-coal cones, the front end of the shaker being used as a carrier for the egg size and under, mixing it with the material from the No. 2 Rolls where it is discharged onto the roller egg coal shakers. This is also a set of two shakers, the top one sizing out broken coal and discharging into the No. 3 Rolls which are set to crush to egg as the largest size. The second shaker is so designed that the egg coal may be sized out separately and sent to the No. 3 Rolls or discharged with the smaller sizes bypassing the No. 3 Rolls and converging with the material from the No. 3 Rolls onto the domestic sizing shakers. This group, consisting of four shakers, sizes out egg, stove, nut and pea, discharging directly into the pockets for loading into railroad cars. The slate in the material fed into the top of the chance cone sinks in the fluid mass and is trapped out by alternate opening and closing of the two slate valves. This slate (refuse) passes over a desanding screen and is then discharged onto a rubber belt conveyor 48" wide discharging into the refuse pocket. The sand and water from both coal and refuse desanding screens goes to the sand pump in which

the sand settles toward the bottom. It is then pumped by the sand pump directly back to the top of the cone while the water overflows the top and is pumped for agitation water.

Handling of Fine Coal

The fine coal from the hoppers under the "Bull" shakers and domestic feed shakers is chuted to the fine-coal feed shakers consisting of two sets of two shakers each; the top shaker sizes out the No. 1 Buckwheat (9/16" x 5/16") and the No. 2 Buckwheat (5/16" x 3/16"); the bottom shaker sizes out the No. 3 Buckwheat (3/16" x 3/32"). The material from these shakers is fed into a double 10′ chance cone the specific gravity and operation being the same as the larger cone. The coal from this double cone is discharged onto the fine-coal sizing shakers consisting of two sets of four shakers each, sizing out No. 1, No. 2 and No. 3 Buckwheat, and discharging directly into the pocket for loading into railroad cars, the coal from the lower deck or No. 4 Buckwheat (3/32" x 3/64") is discharged into a small conveyor which elevates it to a point where it flows into a 6′ diameter hydrotator.

The material from the hoppers under the fine-coal shakers, amounting to about 2,000 gallons of water per minute and 60 tons of No. 4 Buckwheat and silt (3/64") per hour, is discharged onto a 5′ x 10′ vibrator screen where the material is dewatered and the No. 4 Buckwheat (3/32" x 3/64") is reclaimed, and mixing with the No. 4 Buckwheat from the small conveyor previously mentioned is discharged into the 6′ hydrotator where it is cleaned, dewatered and placed in the pocket for loading into railroad cars. The hydrotator is a hindered settling type cleaner, establishing a gravity of approximately 1.70 by the introduction of water through revolving nozzles at the bottom of the machine and the agitator effect of these nozzles. The refuse from this hydrotator is discharged from an elevator direct to the refuse shaker.

At the bottom of the loading pockets for the egg, stove, nut and pea sizes is a shaker called the lip screen shaker which removes all the breakage that may have been made in the pocket; this material goes through the lip screen and is returned by the lip screen conveyor to the breaker. This shaker also acts as a feeder, the coal passing over the screen feeding onto a belt loading boom where the coal is loaded into the railroad cars for shipment; on the sizes below pea the coal is loaded directly into the cars.

Each car is inspected for slate and bone in the egg, stove, nut and pea sizes and for ash content in the Buckwheats Nos. 1, 2, 3 and 4, and every car is tested for sizing. This inspection is done under the supervision of the chief coal inspector who reports directly to the general manager; thus the inspection department is separated entirely from the colliery organization. The inspection is conducted under the scale of tolerances approved and adopted by the Anthracite Institute—cars failing to meet these requirements are condemned and rerun through the breaker for repreparation.

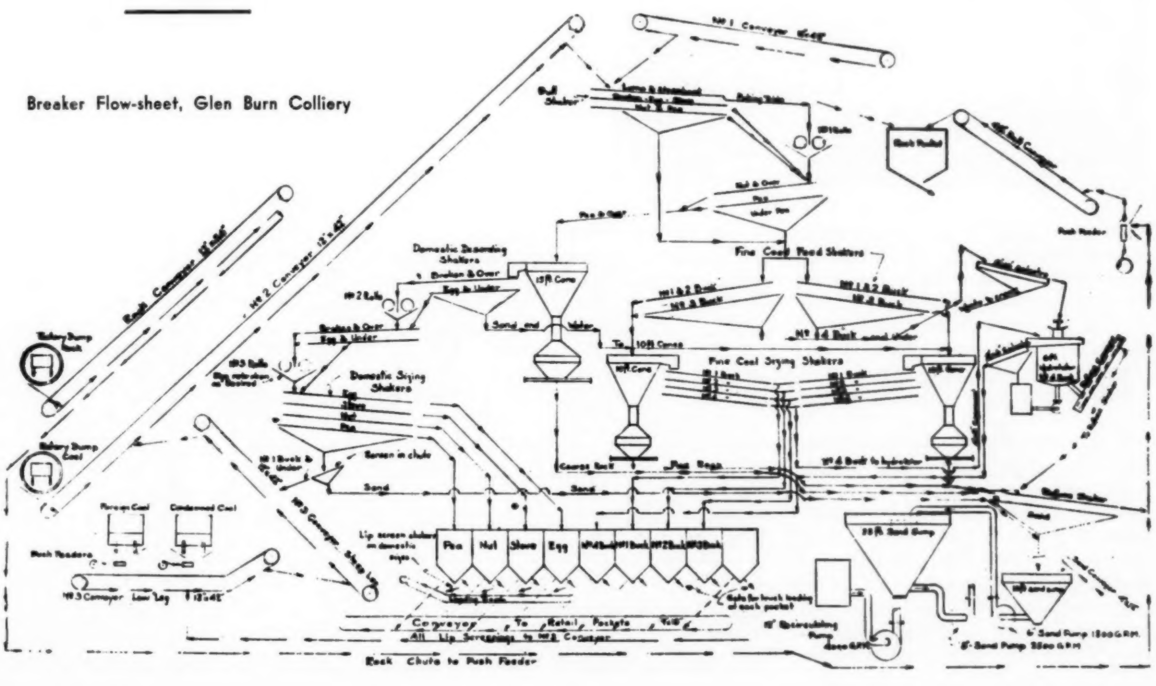
Disposal of Rock and Refuse a Problem

The disposal of mine rock and refuse presented quite a problem in view of the fact that the cleaning plant is located in a narrow gap in which there are a creek, two railroads and a highway.

The mine rock from the west drift is dumped into a separate rotary dump where it is conveyed by a conveyor of double 9" pitch link and pin conveyor chain with 12" x 54" flights spaced 54" centers. This conveyor is supported over the railroad tracks and to the rear of the breaker on a separate steel structure where it feeds by means of a push feeder onto the 48" belt conveyor rising 3" per foot and discharging into the refuse hopper at a distance of 133 feet.

(*Continued on page* 41)

Breaker Flow-sheet, Glen Burn Colliery



The SCREENING of COAL*

• *Market Conditions Require a Closely Sized Product. New Screens and New Screening Techniques Are Available to Suit the Most Exacting Conditions.*

By G. R. DELAMATER
Assistant Vice President
The W. S. Tyler Company

THIS paper has to do only with the screening of bituminous coal. That this subject is of more vital interest today than at any previous time in the history of the coal industry is indicated by the paper presented at the meeting of the A. I. M. E. in New York in February, 1940, by Mr. Thomas Fraser, written by Fraser, W. L. Crentz, and F. G. Tryon.

The title of that paper was "Sizes and Grades of Coal Produced in the United States in 1937." While the data submitted by Mr. Fraser represent only the year 1937 they are of great value in that the data were compiled from reports received from 2,391 mines, said to account for 99 percent of the production of shipping mines in that year.

Table No. 1 is a resumé of great interest and a chart has been prepared, with the first column added to identify the district numbers of the next column.

The third column, showing the total number of sizes produced in each district, shows some rather startling figures, and I doubt if any of us had any realization of such conditions before these data were presented at the New York meeting.

The figures in this third column do not, of course, mean that so many sizes of coal are made by screen separations. Most of these sizes are a result of remixing in varying percentages the 6, 8, or 10 sizes actually made, and are undoubtedly more a result of salesmen's propaganda than anything else.

The data given in the fourth, fifth, sixth, and seventh columns are more truly representative of the sizing practiced by the majority of mines and larger tonnage operations, but even these sizes are of greater number than most of us had realized.

Finer Mesh Screening Demands Vibrating Screens

Shaker screens of various designs have always dominated the bituminous coal tipple, first because for many years no effort was made to screen below 1¼ in., 1 in., or ¾ in. round hole; and second, because they lend themselves nicely to conveyance while screening, that the various prepared sizes may be delivered to railroad cars on paralleling railroad tracks. They also require a minimum of headroom.

The high percentage of slack coal, plus falling slack coal market prices, created a desire for finer-mesh screening, but the shaker screen proved inefficient for such separations under the normal conditions as regards surface moisture content, and vibrating screens of various types have been developed which have made it possible to screen to as fine as 28-mesh without the need of drying the coal.

The competition of gas and oil has necessitated the development of household stokers to eliminate, as far as possible, the dirt and drudgery of the old methods of furnace heating, but it was soon found that the fine dust resulted in many mechanical difficulties and de-dusting at from 48-mesh to 10-mesh has become almost universal.

The surface moisture content of the coal largely determines the minimum separation size that can be efficiently made on shaker screens, and usually separations below 1¼ in. are now made on mechanically vibrated screens.

Many successful installations of these screens have been more recently made with separations up to 6-in. round hole, thus replacing the shaker screen where conditions are suitable. (Figure No. 1.)

The minimum size separation possible on mechanically vibrated screens depends entirely upon the surface moisture content of the coal. There are many efficient installations separating as small as 10-mesh, but again where surface moisture is high the separations on that type of equipment may have to stop at ¼ in., or even larger.

For separations beyond the low limit of mechanically vibrated screens the

TABLE NO. 1.—RESUME OF DATA ON DOMINANT SIZES

	Dist. No.	Total No. of sizes	No. of sizes amounting to 100,000 tons	No. of sizes made by 10 pct. or more of mines	Dominant sizes: Combined tonnage	Dominant sizes: Percent of total tonnage
Central Pennsylvania	1	105	21	6	17,193,580	65
Western Pennsylvania	2	98	40	11	31,988,833	68
Northern West Virginia	3	115	22	20	7,052,994	54
Ohio	4	63	15	12	8,794,674	52
Michigan	5	10	..	..	210,086	94
Panhandle West Virginia	6	52	4	27	2,029,329	68
W. Va. and Va. Smokeless	7	118	40	12	31,732,681	63
W. Va., E. Ky., Tenn., Va	8	169	54	20	35,189,857	51
West Kentucky	9	59	9	18	3,905,402	75
Illinois	10	126	35	23	16,897,545	56
Indiana	11	81	21	24	4,678,184	48
Iowa	12	35	2	13	1,065,889	82
Alabama	13	63	13	12	2,418,004	60
Arkansas-Oklahoma	14	65	3	12	657,051	47
Mo., Okla., Texas and Kansas	15	72	10	13	3,636,079	75
Colorado	16	16	5	13	1,712,240	86
So. Colorado and No. New Mexico	17	46	7	13	1,835,748	65
New Mexico	18	34	1	17	323,953	70
Wyoming	19	40	3	20	687,306	58
Utah	20	22	7	14	2,537,049	89
Montana	22	25	2	13	491,587	77
Washington	23	69	1	14	586,061	44
Total					175,624,132	60

* Paper presented at the annual meeting of West Virginia Coal Mining Institute, October, 1940.

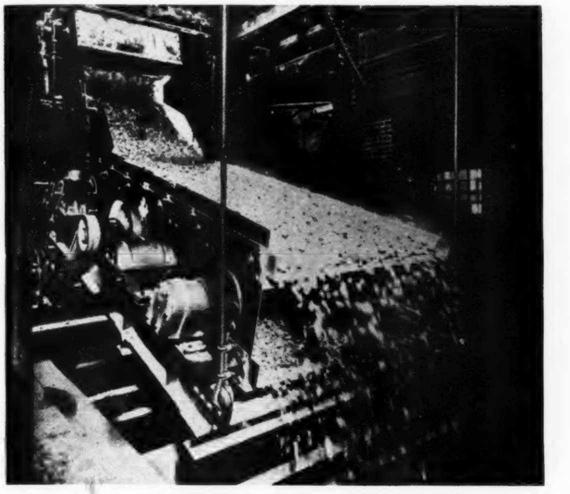


Fig. 1
Mechanically vibrated screens are replacing shaker screens for separations up to 6 in., round hole

electrically vibrated screen is required, and for separations below 10-mesh an electrically vibrated screen with impact has been found an absolute necessity. (Figure No. 2.)

Steep Pitch Aids Screening at Fine Mesh with Coal of High Surface Moisture

In this connection it is the writer's experience that for fine-mesh screening of high surface moisture coal at a commercially profitable capacity per square foot of screen area it is definitely necessary to operate the screen at a steep pitch of 36° to 38° so as to maintain a thin bed on the screen such that the troublesome wet fine dust can be whipped through the screen cloth before there is any chance of it packing into a mat and getting into an unscreenable condition. For example, to attempt to screen a coal of fairly high surface moisture content, making separation at 20 or 28 mesh, and bedded on the screen to a depth of 3 or 4 in., screen vibration tends to pack this bed so solidly that the fine damp dust coal is unable to work its way downward through the coarser sizes to the screen cloth where the separation must be accomplished. It is also true that for such fine mesh separations long - stroke vibration which throws dust coal off the screen cloth surface retards efficient separation at high capacity per square foot of screen area.

There are three large coal-preparation plants in Illinois and a fourth under construction using screens to remove the minus 28 mesh dust from $\frac{5}{16}$ in. x 0 coal and which for this purpose employ 4-ft. x 8-ft. screens operated at an inclination of 38°, each screen taking a feed of 30 tons per hour and removing from 80 to 90 percent of the minus 28 mesh dust in the feed. These screens are of the electrical impact type employing 3,600 vibrations per minute with stroke of $\frac{1}{32}$ in. The surface moisture is such that no enclosure of these screens is required and there is not as much dust about these screens as there is around some of the conveyor transfer points in other parts of the plant. The screen cloth used is a stainless-steel special Ton-Cap weave, with slots lengthwise and stretched to drumhead tension over a backing cloth stretched sidewise, all supported on rubber bridge rails. The life of the stainless-steel facing cloth is about one year.

Almost exactly the same equipment is employed since 1932 near Logan, W. Va., for a 20 mesh separation of $\frac{1}{4}$-in. x 0 coal. This installation was fully described in an article written by Mr. Thomas A. Stroup, assistant to operating vice president of the West Virginia Coal & Coke Co., and published in the March, 1938, issue of *Mechanization*. In this article Mr. Stroup states that the 20 mesh facing cloth has a life of six months and that blinding only occurs when the surface moisture content of the minus 20 mesh coal is 10 percent or more. Since that paper was published, stainless-steel facing cloth has been employed which has increased the life to about one year.

Factors Influencing Screen Capacity

Screen capacity is contingent on many things, but mainly is dependent upon the following conditions:

1. Surface moisture content of the coal.
2. Screen analysis of the feed—more particularly the percentage of sizes close to the opening of the cloth to be used in the screening operation.
3. Screening efficiency required.
4. Inclination of the screen.

Analyzing these in order, (1) the inherent moisture content of coal is of no importance as effecting screen capacity. Surface moisture is, therefore, the item of importance, and so the method employed of determining the surface moisture content is a prime factor. From a purely technical standpoint there is a wide variation of opinion as to the most satisfactory method of determining surface moisture, and I do not propose to enter into that controversy in this paper. Instead, I present the method I employ as one which we have found practical and sufficiently accurate for our needs and can be employed even by the mine of average equipment and not employing chemists or other technicians. A weighed coal sample should

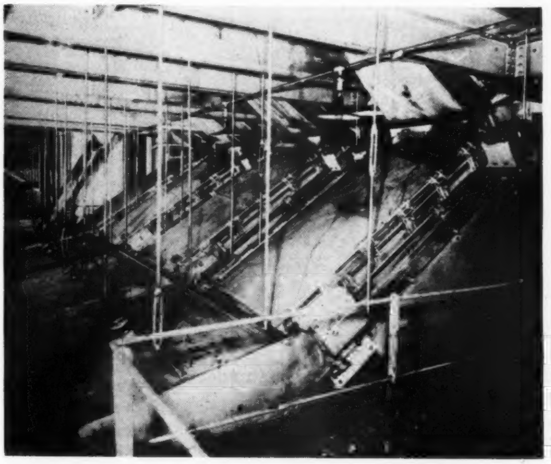


Fig. 2
Type 400
Electric Screen

be spread out to a depth of not to exceed 1 to 1½ in. in a suitable large-area shallow pan and either air dried or dried over steam coils to the point that upon stirring no surface moisture is apparent and no moisture noticeable on the bottom of the pan. The loss in weight divided by the original weight of the sample is the percentage of surface moisture which effects screen capacity.

(2) As an example of the effect of screen analysis on capacity, assume Problems A and B screening a ½-in. x 0 coal making separation at ¼ in. For Problem A the screen analysis shows 75 percent through the ¼-in. screen and 25 percent over, while for Problem B this is reversed to 25 percent through and 75 percent over.

That condition alone will effect the capacity of the screen, but there is yet another feature of the screen analysis that may have even greater effect. Ordinarily Problem A would permit of greater screen capacity than Problem B because of the necessity of conveying less tonnage the full length of the screen deck.

Problem:	A percent	B percent
Retained on ¼" screen..	25	75
¼" x ⅛" coal	60	15
Through ⅛"...............	15	10
	100	100

However, if the screen analysis further shows that in Problem A there is 60 percent ¼-in. x ⅛-in. coal and 15 percent minus ⅛-in. while in Problem B there is but 15 percent ¼-in. x ⅛-in. coal and 10 percent minus ⅛ in., the capacity of the screen for Problem A is materially reduced to close that of Problem B, as the undersize cannot pass so freely through the screen mesh. This ¼-in. x ⅛-in. coal is classed as a "near-mesh" material and should always be closely studied.

(3) This requires no special notation as it is clearly evident that a screen operated at 95 percent screen efficiency cannot be given as high a tonnage feed as one operated at a required efficiency of but 80 to 85 percent.

(4) In discussion of this subject I confine my remarks to my experience with the screen equipment as manufactured by the company with which I am connected. Our electrically vibrated screens are all designed to operate at steep inclinations—32° to 38°—dependent upon conditions to be met. Our mechanically vibrated screens can be operated horizontally if desired, can be operated "up hill" if necessary, as in dewatering, or may be inclined at any desired angle in the direction of the flow of the material over the screen.

Various Inclinations May be Used

It is our experience that these screens will operate as efficiently at 20° inclination and shaft rotation against the flow of material as will result with the screen in horizontal position and shaft rotation with the flow. However, the inclined screen makes some use of the force of gravity in conveying material over the screen deck, and as the horizontal is approached the use of the force of gravity is reduced and must be substituted for by electric power. Furthermore, a longer stroke is required at horizontal position than is necessary at 20°. Then, too, the longer the stroke the shorter is the life of screen cloth, and under certain conditions coal breakage increases with increase of stroke. We also find that about 50 percent greater screen area is required to handle a given tonnage feed of coal on a screen in horizontal position than is required if operated at an inclination of 20°.

For the reasons stated it is our custom to recommend an inclined screen rather than a horizontal screen that the operating and maintenance costs may be at a minimum, but where headroom is of great importance we have no objection to installing our mechanically vibrated screens in a horizontal position.

Essential Data Sometimes Lacking on Which to Base Selection of Screens

The information just presented brings us to a matter of utmost importance to every screen-equipment manufacturer. I refer to the usually almost total lack of essential data as furnished us in the screening problems as presented by our prospective customers. The majority of inquiries state the tonnage feed and the separations desired, but usually neglect to state whether the separation is round or square hole. The moisture, if stated at all, seldom specifies whether it is surface or total moisture and if questioned the reply is usually uncertain. Some inquiries state the percentage expected over and through the screen, but a screen analysis of sufficient completeness that the percentage of near-mesh particles can be determined is not available in at least 95 percent of the inquiries. Screening efficiency desired is seldom stated, and inquiry regarding this feature usually results in a very indefinite reply.

It might be added here that the actual practical needs as regards screening efficiency are often misunderstood. For example, a ⅝-in. x ¼-in. household stoker coal containing more than 1.8 to 2.0 percent fine dust would be of inferior grade, yet it might contain 6 to 8 percent of ¼-in. x ⅛-in. near-mesh undersize without being at all objectionable. Thus it will be seen that a ⅝-in. x ¼-in. stoker coal containing 6 percent ¼-in. x ⅛-in. near-mesh undersize and 2 percent minus ⅛-in. dust, a total of 8 percent undersize (92 percent efficiency), may be a better coal than one containing a total undersize of but 6 percent (94 percent efficiency) but with 2.5 percent ¼-in. x ⅛-in. near-mesh and 3.5 percent minus ⅛-in. dust. Thus it is seen that a careful study should be made of the undersize found in any prepared size of coal.

Wet Screening

There is very little wet screening done in the bituminous coal mining industry. Some strip-mine operations resort to wet screening where the finer mesh separations are necessary and where the exposure of the coal to the elements has resulted in high surface moisture content.

Fine slack coal containing a high percentage of surface moisture has a tendency to cling together to such extent that it will pass through one pressure spray after another without freeing the finer particles from one another. Best results in fine-mesh wet screening are obtained by first thoroughly mixing the coal with water and feeding a fluid mixture to the screen. This usually results in 90 to 95 percent of the undersize passing through the screen mesh with the water in the first 2 or 3 ft. of screen length, and water sprays can then be used if necessary to clean out as much as possible of the remaining undersize. Pressure sprays for fine-mesh screening have a great tendency to drive near-mesh particles so tightly into the mesh as to cause serious blinding of the cloth, and their use should be avoided if at all possible. It is not good practice to attempt to wet-screen coal and dewater it on one and the same screening unit. It is impossible to so control the feed conditions that there will not be a wide variation in the nature of the feed, this requiring excess screen length to assure high wet-screening efficiency. The over-screen product of the wet screen should deliver to a separate dewatering

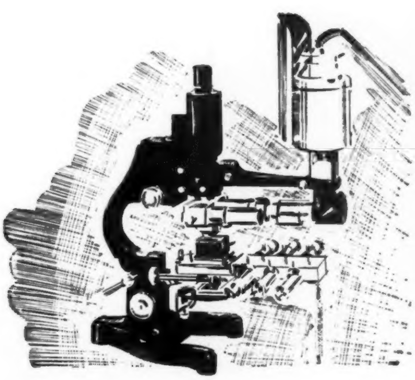
(*Continued on page* 33)

nuggets that Nature planted in stream beds. Today they seek Chromite, Molybdenite, Cassiterite, Cinnabar or any one of a score of other minerals that their grizzled forebears would not have recognized — or recognizing would have passed by because there was then neither demand for these ores nor a profitable way of separating the metal from the waste rock.

The modern prospector is a chemist, yes . . . but the metallurgist working in a laboratory is a prospector, too—and an extremely successful one. For he has developed the incredibly efficient chemical processes of cyanidation and flotation for separating metals from low grade ore. As a result, all over the world "worked out" mines are being reprospected, revaluated and reopened. Tailings dumps of long-forgotten lucky strikes are being retreated with profit. Fifty-year-old veins are being mined more than a mile deep into the earth for ore that assays only four pennyweights of gold to the ton. And entirely new mines for a great variety of minerals are being opened up — mines that only a generation ago would not have been worth the cost of filing a claim!

In Cyanamid's Ore Dressing Laboratory, where many basic metallurgical chemicals have been developed, scientists work constantly with the most modern equipment to produce still more efficient chemical reagents and processes. And in every mining field of the world Cyanamid Field Engineers are working shoulder to shoulder with operating officials to make these newer chemical discoveries bring higher yields at lower cost.

Whether your property is large or small, nearby or remote . . . whether your ore can best be concentrated by cyanidation, by flotation or by a combination of these processes with older recovery methods, Cyanamid Field Engineers and the Cyanamid Ore Dressing Laboratory welcome the opportunity to help you develop a flow scheme to achieve higher recovery at lower cost. We invite you to use Cyanamid Service to Metallurgy.



Printed in U.S.A.

0 ROCKEFELLER PLAZA • NEW YORK

unit, assuring full length of that unit for dewatering only. This will result in a more consistent dewatering efficiency.

Steeply inclined screens can be efficiently used in wet screening providing the feed conditions do not vary too greatly, but they should never be used for dewatering purposes. They will remove surplus water only. (Figure No. 3.) Horizontal or up-hill screens are best for dewatering of coal. Wedge-wire screen decks have been extensively used on high-speed shaker or reciprocating dewatering screens but have not proved so satisfactory on high-speed vibrating screens on account of the difficulty of holding the wedge-wire deck in place.

Stainless Steel Facing Cloth Replacing Wedge Wire

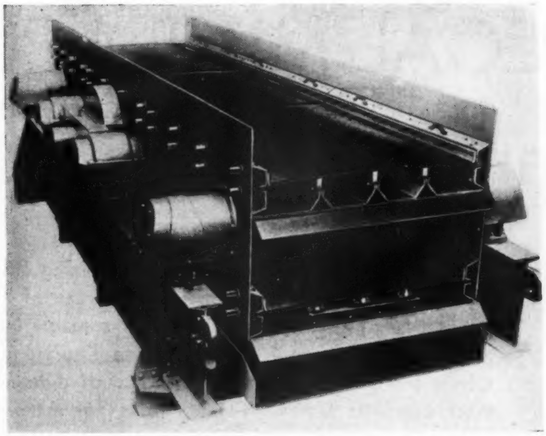
While wedge wire has long been accepted as highly efficient for dewatering purposes, the fact that surface wear results in widening the opening has resulted in a slowly increasing loss of coal through the deck. The high cost of wedge wire necessitates its continued use until considerable surface wear has taken place, and it is not uncommon to find a ½-mm. opening wedge-wire deck used until the width of opening has increased to 1½ mm. Wedge wire having been manufactured only in Germany and England has made the cost high and delivery uncertain, and since the war it has become practically impossible to get any from these sources. As a result, stainless steel Ton-Cap facing cloth tightly stretched over a suitable backing cloth has come into extensive use, and many report the dewatering efficiency at least equal to that of wedge wire and the coal losses from the widening opening entirely eliminated. Furthermore, woven-wire screen cloth provides a much greater percentage of open area than is possible with wedge wire, which undoubtedly accounts for the high dewatering efficiencies that are being obtained.

To assure both high screening and high dewatering efficiencies when using woven-wire cloth, and also to assure long life of same, great care must be taken in its application to the screen body. Screen cloth must be well supported and tightly stretched.

Special Weaves Increase Screening Efficiency

Square-mesh cloth assures accurate screening but has a tendency to blind. (Figure No. 4.) Weaves with a length of opening about double the width greatly overcome that difficulty, and cloth has now been developed in which the length of opening is from 2 to 5 in., depending on the combination of opening width and wire diameter. Such cloth has made some fine-mesh separations possible that could be accomplished in no other way.

Fig. 3
Ty-Rock Dewatering Screen



There are, of course, many other special weaves of wire cloth which are available to meet unusual conditions.

Stainless steel has done much for the screening art, as it not only resists corrosion but also presents at all times a hard, extremely smooth surface that greatly speeds up the screening action. It is almost indispensable for the extremely fine-mesh separations.

Developments in Coke Screening

As great tonnages of bituminous coal are used in the manufacture of coke, some recent developments in coke screening may be of interest.

Disc grizzly screens have long been employed in making the larger-mesh separations. These grizzlies are made up of a great many discs on each of several shafts, all geared together with motor drive to rotate the discs and move the coke over the screen surface. The abrasive coke wears the discs rather rapidly and some will break, but the expense of repairs is too great to be attempted until there are a great number of broken discs or until they become badly worn. As a result the loss of large coke through the screen grows constantly.

We recently conducted some rather extensive tests, using a Ty-Rock screen with 8-in. clear square openings, the coke being a by-product even foundry coke which was very large and chunky, about 10 percent larger than 8 in. We rather expected these large chunks to get down into the 8-in. openings and stay there, but experienced no such trouble, and the consensus of opinion of those who witnessed the test was that the use of this screen for this type of work was thoroughly practical and could be operated and maintained at much lower costs than the disc grizzly and would largely eliminate the loss of coke through the screen that should go over.

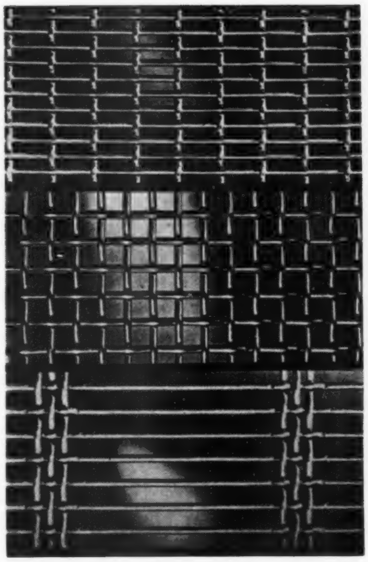


Fig. 4. Ton-Cap Square Mesh and Ty-Rod Screen Cloth

It has been my experience that by far the greater number of screen operators are so situated that highly technical operation, maintenance, and control is impossible. Likewise, few have much if any laboratory equipment available and they want and need the methods of control that employ only such equipment as may be found at the average coal mine operation.

Production of bituminous coal for the week ending March 1 is estimated by the Bureau of Mines at 10,790,000 net tons, the highest production for any week since March, 1937.

COAL MINE ACCIDENTS in 1940—an Unenviable Record

Tables and statistical analyses of coal mining accidents in 1940, assembled and supplied by the U. S. Bureau of Mines, are here published as presenting in cold facts the magnitude of the problem of safety in coal mining. These figures speak for themselves, and point out the particular points demanding quick and most energetic action. Fatality rates per million man hours of exposure were reduced in 1940 over 1939 in the classes of accidents due to Falls of Roof and Coal, Machinery and Electricity. The fatality rates were increased in the classes of accidents due to Haulage, Explosions and Explosives. The largest increase was that due to Explosions.

\+ \+ \+

TENTATIVE figures already assembled place the number of fatal accidents in the coal mines of the United States for 1940 at 1,420 against a much better similar (final) figure of 1,078 in 1939. A search of past records indicates that more men were killed in our coal mines in 1940 than in any year since 1931, when the fatalities in the coal mines of the United States totaled 1,463. Table 1 gives in detail the figures upon which the above totals for 1939 and 1940 were based; the figures for 1939 are final, those for 1940 are an estimate of what the final figures are likely to be by applying to the actual reported fatalities at the present time a factor that considers deaths which occurred in 1940 but for various reasons have not yet been reported.

In having the largest number of fatalities since 1931, the year 1940 was unfortunately signalized also by more fatalities from major explosion disasters (276) than any year since 1928, when 326 were killed in major disasters in the coal mines of the United States. The six major coal-mine disasters in 1940 averaged 46 fatalities per disaster, the highest average number of fatalities per major disaster in coal mining in the United States since 1906 with the two exceptions of an average of 58 per major disaster in 1913 and of 51 in 1907. Four of the six disasters, with a total of 195 fatalities, were believed to have been started by electric arcs, one by blasting on shift (72 fatalities) and one by smoking (9 fatalities). If it had not been for these six major disasters, the rate of occurrence of fatal accidents in the coal mines of the United States during 1940 would have been materially lower than in 1939 (one of the safest years in the history of coal mining in the United States); therefore, the most pressing problem now confronting the coal-mining industry undoubtedly is how to avoid major disasters, and at the same time to continue to reduce accidents from all other causes.

Table 2 gives information on fatalities, fatality rates, and tonnages of the coal mines of the United States from 1931 to 1940, inclusive. It will be noted that much more coal was produced in 1940 than in 1939; in fact, the output was higher than in any other year since 1930, when 536,911,136 tons were produced. On the basis of fatalities per million man-hours of exposure, the year 1940 had a poorer record with a higher rate (1.879, tentative) than any other year listed in Table 2 except 1932, when the rate was 1.897. From the viewpoint of fatalities per million tons of coal produced, the tentative rate of 2.82 fatalities per million tons of coal produced was higher than in 1933, 1936, 1938 and 1939, but a search of

TABLE 1.—FATALITIES IN COAL MINES OF THE UNITED STATES IN 1939 (FINAL) AND 1940 (TENTATIVE)

Underground	Bituminous 1939	Bituminous 1940	Anthracite 1939	Anthracite 1940	Total 1939	Total 1940
Falls of roof and coal	500	557	121	100	621	657
Haulage	155	200	27	39	182	239
Local dust and gas explosions	15	14	3	4	18	18
Major dust and gas explosions	28	276 *	...	...	28	276
Explosives	15	30	17	9	32	39
Electricity	49	35	2	7	51	42
Machinery	37	27	1	3	38	30
Shaft	5	11	6	3	11	14
Miscellaneous	19	30	14	7	33	37
Total underground	823	1,180	191	172	1,014	1,352
Stripping or open cut	9	13	7	3	16	16
Surface	35	45	13	7	48	52
Grand total	867	1,238	211	182	1,078	1,420

* This figure was increased from 274 to 276 because two men originally announced as seriously burned in one explosion died later on.

TABLE 2. COAL-MINING FATALITIES AND FATALITY RATES AND TONNAGE—1931-1940 INCLUSIVE

Year	Number of fatalities (anthracite plus bituminous)	Deaths per million man-hours of exposure	Deaths per million tons of coal produced	Tonnage (anthracite plus bituminous)
1931	1,463	1.819	3.31	441,750,978
1932	1,207	1.897	3.36	359,565,093
1933	1,064	1.480	2.78	383,171,877
1934	1,222	1.593	2.93	416,536,313
1935	1,242	1.695	2.925	424,632,005
1936	1,342	1.624	2.73	491,138,762
1937	1,413	1.741	2.83	498,792,928
1938	1,105	1.779	2.79	395,696,632*
1939	1,078	1,589	2.41*	448,131,000*
1940	1,420*	1.879*	2.82*	503,331,000*

* Tentative, as estimated 1941, by W. W. Adams, Employment Statistics Section, Bureau of Mines. These figures are likely to vary but slightly from the final figures, which will not be available for several months.

past records shows that it was much lower than in any year before 1933.

TABLE 3. FATALITY RATES PER MILLION MAN-HOURS OF EXPOSURE AT ALL COAL MINES IN THE UNITED STATES, 1931-40

	Underground *							
Year	Falls of roof and coal	Haulage	Explosions	Explosives	Machinery	Electricity	Others	Underground open-pit, and surface †
1931	1.280	0.354	0.131	0.060	0.033	0.097	0.134	1.819
1932	1.198	.342	.323	.069	.053	.090	.084	1.897
1933	.979	.329	.068	.058	.042	.090	.090	1.480
1934	1.092	.312	.082	.057	.049	.089	.113	1.593
1935	1.106	.380	.082	.083	.058	.075	.122	1.695
1936	1.102	.338	.084	.076	.056	.077	.127	1.624
1937	1.089	.413	.174	.068	.057	.084	.093	1.741
1938	1.195	.327	.206	.067	.054	.079	.109	1.779
1939	1.129	.331	.084	.058	.069	.093	.080	1.589
1940 ‡	1.025	.373	.456	.061	.047	.066	.080	1.879

* Rates computed on man-hours worked underground.
† Rates computed on total man-hours.
‡ Preliminary figures.

Table 3, of coal-mining fatality rates per million man-hours of exposure for 1931 to 1940, inclusive, broken down according to the main causes of accidents, gives some food for thought in connection with what occurred in 1940 and also indicates trends for the past several years. It is noticeable that in 1940 the fatality rate from falls of roof and coal (ordinarily constituting around or over half of the fatalities in our coal mines) had a lower rate (1.025 fatalities per million man-hours) of occurrence in 1940 than in any other recent year except 1933, when the rate was 0.979. This fact is encouraging because the prevention of fatalities from falls of roof and coal has always been one of the most difficult problems of producers. The haulage rate of 0.373 fatality per million man-hours in 1940 was higher than usual, being exceeded in the last nine years only by the rate of 0.413 in 1937 and 0.380 in 1935.

This table shows the outstanding effect of the mine disasters in 1940 on accident rates; the rate of 0.456 due to explosions is by far the highest between 1931 and 1940. If the explosion rate were eliminated from the 1940 record, the coal mines of the United States would have had one of the lowest fatal accident rates in the present century. This again shows the very great necessity of eliminating or at least very greatly reducing the occurrence of mine disasters and by the use of readily available procedures (ventilation, watering, rock dusting, permissible devices, and equipment) there is no reason why widespread mine explosions cannot be eliminated or their occurrence reduced very greatly compared with the record of 1940.

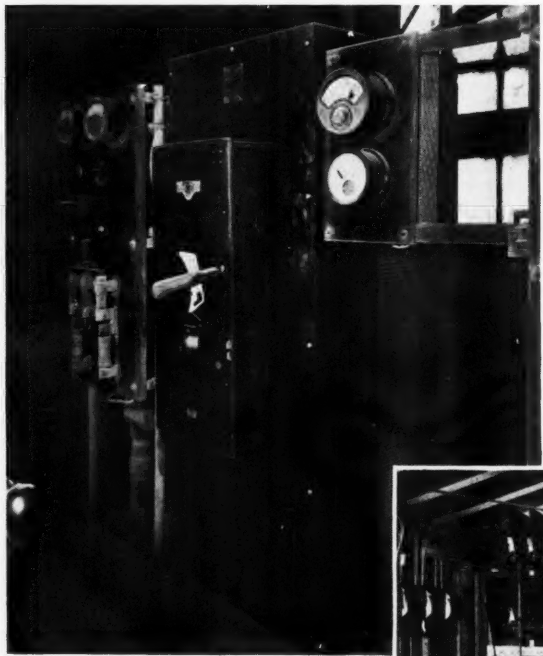
The coal-mining fatality rates (tentative) on an exposure basis in connection with accidents from explosives (0.061) and machinery (0.047) are slightly lower than the average for the past 10 years; however, the fatality rate from explosives does not include fatalities from explosion disasters initiated by explosives; in fact, one of the worst disasters of the year was concluded to have been caused by on-shift blasting with a hazardous type of explosive. The fatality rate from accidents due to electricity was materially lower than the average for the past 10 years, but again this does not include fatalities from mine disasters initiated by electricity; four major disasters (with 195 fatalities) were apparently started by electric arcs. The 1940 coal-mining fatality rate (0.080 tentative) from miscellaneous or *"other"* causes, including those that occurred in shafts or on the surface or in open-pit mines, etc., is about 25 percent lower than the average for similar causes over the 10-year period.

The fatality rate in 1940 (tentative) per million man-hours of exposure for all causes of coal-mining accidents (1.879) is materially higher than the rate of 1.589 for 1939. However, if the rate for explosions is eliminated from both 1939 and 1940, the rate for 1940 would be 1.423 and that for 1939 would be 1.505.

War Interferes With Coal Transport in England

In England transport conditions continue the most pressing of current problems in the coal mining industry, according to a recent article in *The Mining Journal*, London. The report continues: In one or two districts there have been local improvements during the past week; yet embargoes are still being enforced, involving temporary prohibition against deliveries to important consuming areas. The particular case of the anthracite trade was considered by the Minister of Transport at a conference with a deputation from South Wales on Tuesday; the official statement issued by the Ministry after the meeting explained that more than half of the anthracite collieries were idle, and expressed the fear that if a solution of the transport problem was not found the whole of the industry might have to close down. Col. Moore Brabazon promised to give the matter his immediate and careful consideration, and it is hoped that arrangements will be made to prevent the threatened interruption of work, and particularly to secure for the collieries the seasonal trade with Canada, the main export outlet. Shortage of wagons is responsible for short-time working at the Scottish east-coast ports, in Northumberland and Durham, the Midlands and Lancashire, and in some areas merchants are sending their lorries direct to the pits instead of the usual railway depots. It is necessary to emphasize, however, that while these transport difficulties are a serious hindrance to the working of pits in the exporting areas, by far the greater part of current production is being regularly moved from colliery to consumer, and no serious interruption of supplies to munition factories and other essential industries has been reported from any part of the country. Organized action is now being taken to deal effectively with the greatly increased number of unemployed miners in the exporting districts. As from December 1, there has been brought into operation a scheme by which an increased number of miners will be drafted into the armed forces. The reservation age has been increased from 18 to 30, and National Service Tribunals are being set up to decide how many men under 30 can, in view of the available reserves of men over that age, be spared. These tribunals consist of an independent chairman, assisted by a representative of the Miners' Federation and another of the coal owners, and they will be appointed for each of the coalfields of the country. Miners who have not been employed for six weeks are to be called up under the provisions of the National Service Act; otherwise, if they cannot be found suitable employment locally, they are to be placed in other employment (preferably on work of urgent national importance), or allowed to find such employment for themselves. The Mines Department has now authorized a further increase of 1s. per ton in Durham coals both for inland and export as from December 2, and a similar increase on Northumberland soft coals; under the agreements between the mining and the iron and steel industries, providing for the revision of coke prices in accordance with changes in the price of pig iron, the recent advance in iron and steel prices has been followed by a national rise of 2s. 1d. per ton in the f. o. b. at ovens price of blast furnace coke.

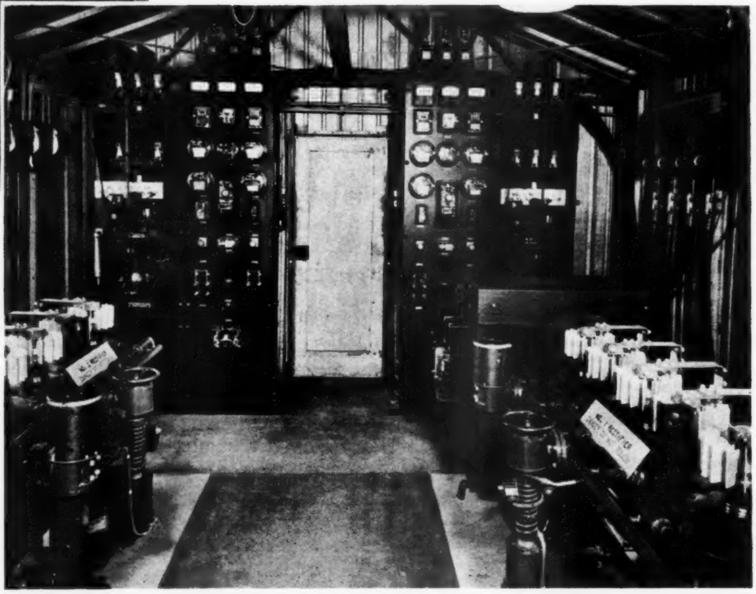
Advances in ELECTRICITY in COAL MINING



Above: 270 kva bank of rack mounted capacitors

● ***Equipment Keeps Pace with Improvements in Mining Methods and Mechanization.***

By D. E. RENSHAW
Industrial Engineer
Westinghouse Electric & Mfg. Co.



Surface substation with two 440 kw, 575 v. Ignitron rectifier units, converting a. c. to d. c.

THE past year has seen the efficiency of electric power grow to a new high level in the coal mining field. More efficient use of motors, better control of costly lagging power factors, safer and more flexible means of power distribution and conversion—all have played their part in providing electricity with ability to do more work easier per kilowatt-hour. Use of capacitors for power factor correction and surge protection, the single-lever cam-contractor-type controller for mining locomotives, fan-cooled motors that do more work but take up no more space than those formerly employed, Ignitron rectifiers with a new system of firing which eliminates the Thyratron tubes, and air-cooled distribution transformers are some of the more important advances that have been made during 1940. The mining industry is taking full benefit of all new and progressive engineering ideas, and are as a consequence finding out that careful application of electrical apparatus to its correct job can bring real efficiency to their operations.

Capacitors Raise the Power Factor

Loading of coal by mechanical methods usually creates the need for a cleaning plant. Most cleaning plants are equipped with machinery driven mostly by induction motors, and usually there are a large number of these motors involved. The inherently low power factor of the induction motor, especially when not operated consistently at rated load, drags down the power factor of the entire mining plant and increases the cost of power.

The answer to problems of this kind has been found in the static condenser or, as it is more commonly known, the capacitor. Frequently it is found that capacitor installations used for power factor correction pay

for themselves in a time ranging from one to three years, and thereafter will effectively reduce power bills.

Under some circumstances, capacitors have been installed to relieve transformers and lines of wattless current, to improve voltage conditions, and to permit installation of additional motors without a corresponding increase in line and transformer capacity. This will usually be a secondary consideration in mining, but its possible benefits should not be overlooked.

Capacitors Protect the Rotating Machinery

Extensive research in the laboratory, and in the field, has definitely proved that the best type of lightning protection for rotating machines is obtained by a combination of a capacitor with a lightning arrester. The capacitor slopes off the steepness of the incoming lightning surge, and the arrester limits the magnitude of the surge. This method of protection is being increasingly adopted as standard mining practice.

Electric Locomotives Made Faster and More Reliable

Although mine locomotives have not changed fundamentally in many years, improvements in details have been made constantly. The past three or four years have seen the introduction of the breather to ventilate explosion-tested controllers; the single-lever cam-contractor-type controller has improved the mobility of locomotives working behind loading machines, especially when used in conjunction with the hand-lever type brake; three-point equalization, formerly used mainly on heavy haulage locomotives, has been applied to gathering locomotives to prevent derailments, and thus avoid delays; pneumatic contractor control has been more widely adopted on heavy haulage locomotives; high-speed self-ventilated motors have been used on haulage locomotives, following their successful use on street cars and trolley buses; and forced ventilation has been applied to haulage motors, to eliminate almost entirely their overheating under sustained severe operating conditions. Result of these improvements in electrical details is a locomotive which performs more work faster, for less money.

Fan-Cooled Motors Make Loading Machines Powerful

As in every mining machine, the physical size of the loading-machine drive motor must be kept to a minimum. Since these machines are used at the working face, a large proportion of them incorporate totally enclosed permissible motors. The most effective use is made of available space if the motor is fan-cooled. Fan-cooling increases the physical size of the motor only slightly, but increases its continuous capacity as much as 100 percent in some cases.

Magnetic contactor control for loading machines has been almost universally adopted, particularly for the permissible machines. This control, including a thermal-magnetic overload relay with lockout feature, provides high arc-rupturing capacity, adequate overload protection, and effectively improves the reliability and reduces the maintenance.

Better Built Motors Stand Heavier Overloads

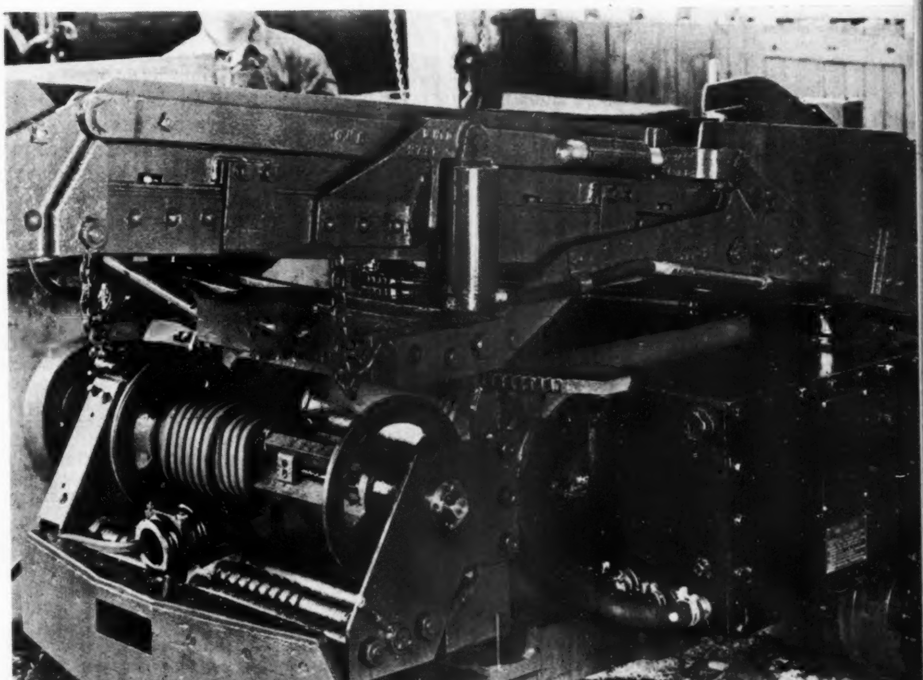
Motors on shortwall and longwall cutting machines and motors mounted in the heads of universal machines are, of necessity, totally enclosed, non-ventilated motors. Through better materials now available, these motors are being built for continuous operation at heavy loads, as demanded by modern mechanical mining systems, in which the cutter is almost never idle.

Fan-cooling of the auxiliary motor of universal cutting machines has made it possible to apply motors of adequate capacities without any increase in motor space requirements. As on loading machines, contactor control has found wide acceptance on cutting machines.

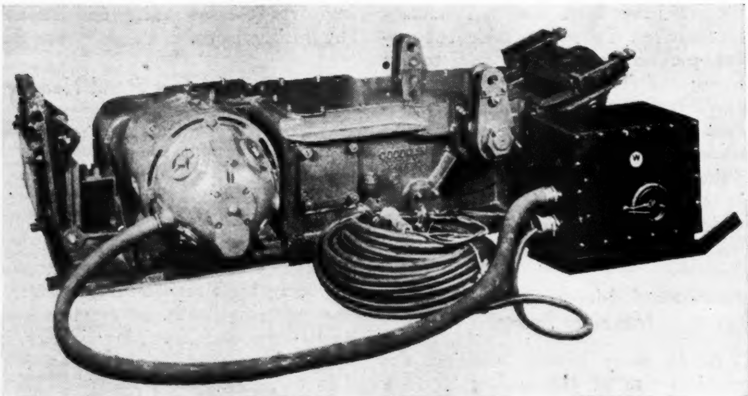
More Horsepower in Same Space Given to Conveyor Drives

Conveyors in "open" mines are almost always driven by drip-proof motors. These motors, being partially open, can carry the same loads as open motors with only a slight increase in temperature.

To drive permissible conveyors, fan-cooled motors are installed to provide



Fan-cooled motors, as installed on this Myers-Whaley loader, permit power increase with no increase in space requirements. Control box at right



Permissible conveyor drive, with totally enclosed, fan-cooled motor

equivalent continuous capacity. These fan-cooled motors have the same mounting dimensions as open motors, and are little, if any, larger in overall dimensions.

Heavier Feeders, Better Bonds, Improve Distribution

Conveyors, loaders, cutters, and other mining machinery can only operate at peak efficiencies when their source of power is sufficient and steady. To assure that power requirements be met, the past year has seen the installation of adequate feeders and bonds in many mines. Special care has been paid to balance the positive feeders and returns so that voltage losses are reduced to a bare minimum.

The use of feeder and sectionalizing circuit breakers to limit the effects of breakdowns has come in for greater attention. Use of such protective schemes permits continued operation of the electrical system throughout all of its sections except the small area affected by the fault.

The Ignitron Gets a Simpler Firing Mechanism

A.c. to d.c. conversion has literally been taken over by the Ignitron rectifier since its introduction to this field in 1936. At present there are 21 active Ignitron installations in coal mines, including the following:

1—200 kw., 275 volts d.c.
10—300 kw., 275 volts d.c.
2—400 kw., 275 volts d.c.
1—300 kw., 600 volts d.c.
2—400 kw., 600 volts d.c.
1—500 kw., 600 volts d.c.
4—600 kw., 600 volts d.c.

The latest improvement in the Ignitron rectifier is a system of "firing" which eliminates the Thyratron tubes, thus reducing the annual maintenance expense by $100 or more.

Air Cooled Transformers Simplify Installation

A new development for underground power is the air-cooled transformer. This non-liquid filled transformer may be used in any location suitable for motor generators or similar rotating machines. Two of these transformers are now in service in an eastern coal mine. With the increase in use of power underground, because they simplify the task of constructing substations and moving transformer equipment, such transformers are expected to have wide application in mining practice.

Economy as a Watchword

Looking over the various improvements in both machinery, electrical drives, and new engineering ideas that have appeared in the past year should bring home the fact that economy in operation does not hinge entirely on the use of new and different equipment, but rather upon a combination of these and existing apparatus fitted to new conditions. Fan-cooled motors to get more power from a given space is a good example of proper usage of existing apparatus to bring about economy. New ideas, new methods of using equipment already on hand, plus a few small modernizations here and there, will, more often than not, enable old plants to operate with new efficiencies. Such ideas and methods are developed not only by the industries directly concerned but also by electrical companies which have been associated with the coal mining industry and its various phases for many years.

South African Fuel Research Progresses

The annual report of the South African Fuel Research Institute, as abstracted by the Iron and Coal Trades Review, London, states that considerable success was attained in 1939 in the completion of coal field surveys and in research coal cleaning. The abstract continues:

"During 1939, in addition to prospecting activities in the coalfields and detailed surveys of specific ores, an examination of the washing characteristics of coal from the Main (No. 2) Witbank seam was concluded, and the performance of a Baum type coal washer fed with coal from this seam was determined. Investigations have also been continued on a method of removing the mineral constituents from coal by grinding the coal and then kneading or shaking it with oil and water. Under suitable conditions the coal forms a paste with the oil, while the greater part of the mineral matter remains suspended in the water and can be removed by washing with water. Experiments with oils of various types and viscosities have shown that the proportion of the total ash removed is independent of the type of oil over a wide range, but the ease with which separation is effected is greatest when oils of medium viscosity are used. By repeated treatment of the coal it has been found possible to reduce the ash content to a minimum value, which may represent the actual inherent ash in the coal, that is, the ash which is so intimately commingled with the coal substance that it cannot be separated by grinding. Tests on the Witbank coal suggest that a preliminary washing of coal does not affect the minimum ash content, though it would affect the cost of grinding. Experiments are being undertaken with the object of producing by this method a suspension of coal in creosote oil or coal oil which would have a sufficiently low ash content and a sufficient stability to allow of its use as a substitute for fuel oil.

"For some time the possibility of establishing an industry in the Union for the synthesis of oil from coal by the Fischer-Tropsch process has been under consideration, the only raw material available being bituminous or semi-bituminous coal, and problems affecting the complete gasification of such coals for the production of synthesis gas have been investigated by the Institute. In 1938 the relative reactivities of coke formed from several typical coals were determined, and in 1939 an investigation was concluded on the effect of moderate pressures on the coking characteristics of a number of weakly caking and non-caking coals.

INDUSTRIAL RELATIONS TODAY

Intelligent industrial leadership recognizes the necessity of establishing and maintaining harmonious employer-employe relationships. A sympathetic and systematic approach to the problems must be made, the burden falling principally on employers. Mr. Heron discusses these problems and the approach needed.

By A. R. HERON
Crown Zellerback Corporation

IT WOULD be easy to discuss industrial relations of the future, or of the past. History is so thoroughly garbled in most fields that one can select examples from the past to prove almost any case; and the future is safe because I shall not enter into any flights into the fields of prophecy. But in considering the question, one must try to remove oneself from the present and get a little of the viewpoint of the past, and guess a little at the viewpoint of the future. We should start from the center of the infection, as I would term it, that has created the uneasiness and disease that we are facing today. That is the activity of the National Labor Relations Board, which Mr. Toland discussed in the October issue of the JOURNAL.*

Starting from there we can explore many of the lesser parts of the problem of the present day. We see nothing else, because they face us in such utter lack of focus that they prevent us from observing the things that are permanent and that go on. Still we must face them. We must live through them or we will have no chance to meet the rest of the problem. Perhaps in our discussion of present-day industrial relations we should move through the development of mass production and the problems that have been created thereby. Mass production means mass employment, and mass employment has created a new problem in industrial relations.

Industrial Relations Have Not Kept Pace with Industrial Development

From my own standpoint, I should have to admit that we have not in our industrial relations field kept pace with the progress of research and invention and development in the physical fields, as well as in the scientific, mechanical, chemical, and electrical fields.

We might trace the decadence of the crafts, as such; of the economy where men owned their tools and, perhaps most important of all, where men saw the completion of their work. The craftsman saw the article he was making come out in completed form, and in that he had the outlet for all of the aspirations and desires that make the human race the agency of divine planning for progress.

That opportunity to see the completion of our own handiwork is denied to most of us today, no matter what our jobs may be.

Specialization Has Led to Dependence of the Worker on His Job

Perhaps we might follow the reduction of emphasis on skill, the development of the mechanization which has produced a world of semi-skilled workmen on semi-automatic jobs, and leading from that, the specialization which is a large factor in the field of industrial relations today; the specialization that has led to the dependence of the worker on the job. He once had his own tools, he had a house and a small garden. When he didn't have enough work to do he could repair his own house and produce much of his own food.

Generally speaking, he cannot do that today. The only thing the average worker has now is a number on the pay roll. Where we have lagged a little was in not recognizing that the number represented his property in this world's goods, and that it was becoming more and more important to him, and he knew less and less about what that number on the pay roll meant. He was ripe and ready, in a large number of cases, to respond to some magic cure that would make that pay-roll number constitute something that he could understand. A lot of forceful preaching has been done, and some very radical and energetic responses have been gained to that preaching.

And then we might devote time to a study of the National Labor Relations Act or its administration, and to some of the collateral measures that are part of the organized phase of the modern industrial relations problem; such things as the Wage and Hour Law, the Social Security Act, the emergence of unions of a new kind, with a new type of so-called leadership; but certainly chief of all these outside influences on modern industrial relations is the National Labor Relations Board.

Returning Draftees Will Affect the Problem

Then, in moving ahead to the future industrial relations problems—not too far in the future—we meet the problem that is going to be created in this country by the defense program. Here we have the problem of temporary replacement of men who serve with the National Guard and as Reserve officers. Those are likely to be men in the key positions in most of our industries. We have an additional conscription problem in the companies with which I am associated.

In these companies we find that about 3,800 men are subject to registration, and that our share of the conscript trainees during the next year will be between 200 and 250 men.

* The National Labor Relations Board by Edmund M. Toland, Mining Congress Journal, October, 1940.

These will be young men; in the main, they will not be in key positions. But still we have to face the necessity of replacing them with men who can do their jobs. We have to face the necessity of keeping those replacements in such a frame of mind that they will recognize that their days in the job are numbered, that they will be displaced when the young man out of uniform comes back. We are under obligation to restore his job to the man serving with the armed forces.

A new element enters into our industrial relations, as a result of this year of training, for the boys who are going as draftees. They will spend a year under a degree of discipline never previously experienced. They are going to spend a year learning, I expect, why it is worth while to defend this system of life and government that we call democracy. They are going to spend a year fitting themselves into an atmosphere of constituted authority. They are going to spend a year learning to shoulder responsibility. And then they will come back into our industrial establishments as marked men. They will be subjects of curiosity to the men who didn't go. "What did you do? How did you like it? Was the top sergeant a so-and-so like mine was in the other war?"

They will have an automatic audience when they get back, and they will be listened to. And with the poise and the maturity and responsibility that will have been given to them by this year of training, they will be in large part natural leaders for the group to which they return.

Going into the field of prophecy, I have no hesitation in saying that we will see, 15 months from now, a change of leadership, a change of philosophy, a change of thought, in many a group of working men who receive back into their number these men who have worn the uniform of the United States, who have taken a particular pledge of allegiance to its flag—an oath of duty to its armed forces—and who have learned why we feel that this experiment and experience of democracy in free enterprise is worth defending. I think it is going to be a happy day.

Problems That Can Only be Treated Collectively an Increasingly Important Part

Perhaps the outstanding point of our present industrial relations is the whole group that we might class under collective problems — collective relations, collective bargaining dealing presumably with wages and hours and working conditions, the contract between you and the men who are going to work for you. There are, they think, too many of them to see you individually, and perhaps they are right; too many of them to permit themselves to compete against each other. And so they bargain with us, they make a deal on the general terms under which they are going to work.

Other present-day problems we are meeting collectively, because they are brought to us by collective action. They are not problems of collective bargaining, which are relatively simple and which today should not be opposed by any intelligent American employer. Collective bargaining is an instrument of American democracy. It is one of the strongest weapons for the protection and preservation of private enterprise.

Seniority and Equality

Perhaps one of the sorest points in modern industrial relations will be the question of seniority and all that hinges around it. Who is going to know whether other things are equal or not when, for instance, we have a seniority clause in a union agreement? And how much have we employers done to determine whether things are equal or not between John and Joe, in their reliability, in their efficiency, in their responsibility for work and their capability for advancement?

Frankly, out of our 12,000 or 15,000 employes I must confess that we have not done nearly as much as we should, to be able to say whether or not things are equal, or whether or not the man with the whitest hair should get the best job.

I doubt whether worker grievances are a problem only of the present. In reading history I find processes for presenting grievances back in 1770 in this country, and probably there were grievances a long time before that. They have been high-lighted and spotlighted and pushed to the front of the stage by collective organization. They have been made matters of emphasis, so much so that it might be said that a great agency of our government was created to deal with them. And if the job was to deal with grievances, then there must have been injustices at that time, if not even prior to that time.

Some time ago I was talking with a man who carries a great government responsibility, a famous liberal and friend of labor. He discussed a strike that was then current in the city of Tacoma, and two smaller cities in northern Washington. It was an American Federation of Labor strike against a decision of the National Labor Relations Board. For the decision, now two years old, I hold no brief, but for the strike against that decision I hold no brief either. This man said, with emphasis, "If this administration surrenders to the strikers it might as well stop trying to be the government of this country."

The men were not striking for anything they wanted their employers to do, but on a demand that the Federal government, through one of its constituted agencies, promise to do a certain thing. After nine days of strike the government, through its constituted agencies, satisfied the strikers it would do what they were asking.

Industrial relations are the relations that we sustain together when we work together. We may have national labor relations boards for the rest of our national life. We may have wage and hour laws, fair labor standards acts, we will have social security acts in one form or another, unemployment compensation, and Federal mediation service, something like the Maritime Labor Commission, and we will have a great many other agencies of that kind. But they are never going to solve the problem for us.

Solution Must Come Through Line Organization

The solution lies in what those of us who have worn a uniform have come to know as line organization. The relationship between the man who works for our corporation and the corporation is not between him and the stockholders, or between him and the board of directors, or between him and the director of industrial relations, or between him and the president. That relationship is between him and the foreman or the straw boss, and it moves right up and down the line of organization. The groundwork that was laid for the intensity of the problems of the last few years was the groundwork of ignorance and misunderstanding, of a closed channel up and down the line organization.

The solution to today's industrial relations problem must come through a real awakening to the fact that the man who works no longer knows the boss, and doesn't believe in a boss that he doesn't know. His loyalty—if one wants to use the word loyalty—is not toward the A. B. C. Corporation, Ltd. His loyalty, if he has such, is going to be to Bud Smith, the straw boss,

because to him Bud Smith is the A. B. C. Corporation, Ltd.

Workers Must Have Access to the Facts

So with a great deal of humility a number of us have set ourselves to the task of seeing that the man who works for wages by the hour has access to the facts that he should know about the American industrial enterprise in which he works. It is no longer a secret that the president of some organization gets a salary of $75,000 a year; it is no longer a secret as to who owns the corporation. It is no longer a secret as to how much profit is being made.

He gets that information anyway. But he never has known how many dollars had to be put into the pot before a job could be created for him. And in our industry, it happens to be nearly $20,000 per worker. We want him to know that it takes $20,000 of so-called capital; that somebody called the capitalist has to furnish that money before he can go to work and earn his 60 cents or 80 cents or a dollar an hour. We want him to know who that capitalist is. We want him to know in our corporation that no one person or interest holds more than a certain percentage of the stock. We want him to know that 90 percent of the stock is held by people in small jobs, and that a considerable percentage is held by people who are working for wages as he is, for the same company.

As we face these matters, I think they narrow down to the problem of understanding.

Growth of an Industrial Enterprise Complicates Relationships

A short time ago a friend, who is both theoretically and practically interested in industrial relations, was talking with a great American industrialist of the Pacific coast who, as a result of his own inventions and his organizing skill, has built up an enormous industry, and who was having some labor trouble.

His friend said to him, "Bill, you have overlooked the fact that when you started there were five men working with you. You were working on your first model, and it was awfully important that it should be good, and should perform. They knew if it performed you were going to get an order for 25, and were going to hire 50 men. These men worked with you; they knew they were going to get better jobs; they knew they were going to get permanent jobs, if you succeeded.

"Today you have 12,000 men, and most of them don't know you except as they read your name in the newspaper, and most of them don't like you because they don't know you. You have lost the personal touch. The thing that you have forgotten to do in the development of this big industry is to furnish a substitute, or a new link, to take the place of that personal contact that you had with the five men who started to work for you in the first place."

This great industrialist said, "You are right. I will have a loud speaker installed so I can talk to all the boys in the plant at once."

It sounds funny. But we have done too much of that, trying to reestablish the relationship between employer and employe over the loud-speaker system, and it doesn't work. It can only be reestablished in the line organization. The employe can have relationship only with the man with whom he works, and by his contacts through that man he can know all of these other facts.

Employers Must Dedicate Themselves Anew to Reestablishment of Proper Relationships

Some of us, as I say, are very humbly setting out on a forgotten and overlooked task. If we have a while to work at it, to make up for lost time, we hope to reach the goal when the 10,000 men working for this company, and the 200,000 working for that, and the 100,000 working for another company will know just where their enterprise fits into this American system. We dare to hope that they will know why it is necessary for stockholders to get profits in order to induce stockholders to furnish $20,000 of capital for buildings and machinery so one man can work for wages.

We feel that the recreation of this feeling of working together, by reason of our willingness to share this knowledge which we have kept away from working men, is going to make the daily life of the American man and woman so intelligible to him that he will see that his life is an integral part of this thing we call democracy.

Unwise Federal laws and state laws, subversive agencies, foreigners preaching a foreign gospel, bad administration of this or that act, can be stopped in one of two ways:

First, by united political action; but second, and most important, by a better understanding, a more free exchange of knowledge by and between management and men in American industry. The political action to curb these things that are threatening democracy is never going to come until the rank and file of American industry understands its place in the picture, and understands the identity of the industrial life in America with the vague thing we call democracy.

Glen Burn Colliery

(Continued from page 29)

This refuse hopper is a separate timber structure from which the material is fed into monitors with a capacity of 177 cubic feet. These monitors are hoisted up the side of the mountain on a plane with a pitch of 18 degrees. This plant consists of two units in series hoisting the material a total of 2,000 feet (vertical distance 594 feet), powered by 200 HP and 250 HP electric hoists. At the top of the plane the refuse is dumped into a hopper from which it is loaded into a 20-ton differential electric 2-way dumper larry with a 10-ton 3-way dumping trailer which conveys the material to the refuse bank. The tonnage of refuse handled in this manner is 2,140 tons per day.

The breaker flow sheet is shown on page 29.

Product is Trademarked and Marketed Widely

The colliery is now producing around 4,500 tons per day, operating on a two-shift breaker cycle with the underground mining operations on a three-shift mining cycle. The final output is sold both locally to trucks and is shipped generally by railroad throughout the eastern seaboard and New England states and has developed an excellent reputation for highest quality blended anthracite. The finished product is trade-marked by large numbers of small, round, red-colored discs distributed throughout either the railroad cars or trucks, with the name Glen Burn and the Susquehanna Collieries Company as producers. The entire output of the colliery is sold through the M. A. Hanna Company of Cleveland, Ohio, who are the general sales agent, and of which company, the Susquehanna Collieries Company is a wholly owned subsidiary.

With the COAL DIVISION

of the AMERICAN MINING CONGRESS

The Enforcement of SAFETY RULES

By G. B. SOUTHWARD
Mining Engineer
American Mining Congress

THE coal industry, during the early part of this century, inaugurated a nation-wide safety campaign and, overcoming the inertia of past generations, a record of accident reduction has been made of which the industry can well be proud. This program started from zero and had a three-way problem; first, to establish the fact that accidents in coal mining could be prevented; second, to design effective safe practices and equipment, and, third, to educate the men underground to work safely.

Until recently coal mining was a hazardous occupation. Certain dangers were inherent and before modern research and study had devised protective measures, little could be done except hope for the best. This constant exposure bred in the miners, not an indifference but a disregard for the possibility of accidents, and those who worked underground were men able to cultivate this disregard. It naturally followed that much safety education was not popular among the miners, as it was felt that such talk merely served to call attention to dangers which they could not eliminate and therefore preferred to forget.

The foregoing relates to the past, but it has a direct bearing on the present because the coal miner of today retains many of the characteristics and habits of thought that have been handed down from preceding generations. Therefore, any program of safety has to take this attitude into account, and develop the psychology which will overcome it.

Digressing for a moment from coal mining, in order to bring out another point of psychology; we as free people of the United States do not accept, too gracefully, rules and regulations that tend to restrict independent individual action. Our attitude toward traffic laws is a good illustration; these are designed to protect people on the streets and highways, but policing in itself never was or never will be successful in attaining this objective. Motorists, even as you and I, had to be convinced, through campaigns of safety education, of the benefits of traffic regulations before their enforcement was possible.

Problems of Enforcement

This national spirit of independence is continually being encountered in the development of coal mine safety programs, and much tact has been needed to meet it. Rules have been formulated to cover all of the possible accident sources, and disciplinary measures have had some effect in preventing violations but, since it is obviously impossible to police every man underground, the most effective method of enforcement has been to enlist cooperation and voluntary obedience. This often requires a high degree of diplomacy, as, for example, in trying to persuade a man to change a practice that is potentially dangerous but one which he has followed for many years without injury. Men like that are really hard to convince, as most of us know from personal experience.

Safety rules are necessary, but there is controversy as to how far they should go. Some operators favor a few basic rules on the ground that these can be rigidly enforced. Others feel that this plan leaves too much to the judgment of the miners, and they prefer to specify practices on all the operations of mining. The Safety Committee favors the latter plan, believing that the main purpose of safety rules is to point out hazards, and unless these are definitely indicated, many dangers will be overlooked and accidents will result through ignorance. The committee further believes that safety rules should be written in brief simple language, clearly expressing the idea but not clouding the issue in a lengthy attempt to make a regulation "air tight."

Reduction of accidents is brought about through the observance of safe practices, and whether this is best obtained through discipline or voluntary cooperation depends on local situations. But, in any situation, one of the most important factors in securing an observance of safety rules is the attitude and the action of the company itself. A good example is the best sermon, and vice versa. A company that complies fully with recognized safety procedure by installing protective devices, by good housekeeping in the airways, walkways and working places, by proper maintenance of brattices, doors, track, trolley lines, power circuits and other equipment, can expect equal compliance with safety regulations from its employes.

A SURVEY OF SAFETY PROMOTION in Modern Coal Mining

IN ORDER to further the work of the Safety Committee, a survey was recently made by the American Mining Congress to get a general idea of the safety programs that are in use in the coal industry. This survey was not a complete census; it covered only a limited number of companies—about 35 in all—but included operations in all the major coal fields, and probably gives a fairly representative cross-section of the practices used in modern operations. A compilation of this survey is submitted below, and this will be used by the committee as a basis for carrying on more detailed studies and future reports.

Many ways have been tried to encourage safety consciousness — first-aid training, rules, discipline, bulletin boards, moving pictures, and meetings. Safety departments, in addition to fire bosses and routine inspection, have been set up by a number of companies for the purpose of educating and instructing the men, and generally securing their cooperation in reducing accidents and eliminating unsafe practices. All of these things have had good results—some, of course, are more effective than others, and there is an agreement that no one single procedure is sufficient, and that a safety campaign by a company must be along rather broad lines.

The coal industry over the past years has been engaged in an intensive program to reduce accidents and, as the records show, a continual and steady improvement has resulted. In the course of this campaign, it has become recognized that the most important step in promoting safe practices is to "sell" the safety idea to the men; rules, regulations and safety equipment are not effective unless the rank and file of the employes take a direct personal interest in guarding themselves and their fellow workers against hazards.

Compilation of Survey on Methods to Promote Safety

1. Safety Department
   - 24 companies have full-time safety departments.
   - 4 companies have part-time safety departments.
   - 5 companies have no special safety departments.

2. Authority of Safety Department
   - 20 companies give their safety departments authority over men and foremen to enforce safety.
   - 10 companies have their safety departments submit recommendations to the mine officials.

3. Discipline
   - 30 companies discipline employes for violations.
   - 3 companies report no disciplinary measures.

4. Bulletin Boards
   - 27 companies post accounts of accidents or safety records.
   - 4 companies do not post these accounts.

5. Safety Competition
   - 14 companies have safety competition.
   - 18 companies have no safety competition.

6. Safety Awards
   - 17 companies give safety awards to employes.
   - 16 companies do not give safety awards.

7. First-Aid Training
   - 30 companies have periodical first-aid training.
   - 2 companies do not have periodical training.

8. Safety Clothing
   - 28 companies require the use of hard hats.
   - 24 companies require the use of safety shoes.
   - 22 companies require the use of goggles for certain occupations.
   - 4 companies require the use of gloves.
   - 1 company requires the use of self-rescuers.
   - 1 company requires the use of respirators.
   - 6 companies encourage but do not compel safety clothing.

9. Employe Safety Meetings
   - 3 companies have regular weekly safety meetings.
   - 10 companies have regular monthly safety meetings.
   - 6 companies have meetings but not at regular times.
   - 3 companies have regular annual meetings.
   - 11 companies have no safety meetings.
   - 9 companies have their executives attend safety meetings.

10. Mine Official Meetings
    - 5 companies have weekly meetings of their mine officials.
    - 26 companies have monthly meetings of their mine officials.
    - 5 companies hold meetings at irregular intervals.
    - 2 companies have no meetings of their officials.

11. Cooperation from Employes
    - 31 companies report satisfactory cooperation.
    - 2 companies report unsatisfactory cooperation.

12. Greatest Safety Factor

    The following answers were given to the questions as to what part of their safety program has the greatest effect in reducing accidents:
    - 9 companies reported "discipline for violation of rules."
    - 6 companies reported "safety meetings of employes."
    - 4 companies reported "supervision."
    - 3 companies reported "safety meetings of officials."
    - 3 companies reported "safety awards."
    - 2 companies reported "safety department."
    - 2 companies reported "inspection."
    - 2 companies reported "education."
    - 2 companies reported "no one feature."
    - 1 company reported "first-aid training."
    - 4 companies reported "unknown."

TENTATIVE SAFETY RULES—

Submitted by the Safety Committee

• *Special Timbering Rules*

1. All timbering in working places should be required to be installed in accordance with the standard adopted by the company. The standard should call for the minimum requirement, and additional timbers should be placed when necessary.

2. The roof, overhead strata and overhanging sides should be required to be supported by temporary posts or blockings and other precautionary measures taken for protection from injury while setting cross-bars or while taking down loose slate, and an unhindered line of retreat should be available.

3. Breakline posts should be required to be maintained at all times at the loose ends of pillars and stumps.

4. In setting props, the foot of the prop should be required to be put on a firm footing and the prop set square with the roof and bottom.

5. Special care should be taken when recovering temporary or safety posts; they should not be permitted to be removed until substitute or permanent timbering has been installed.

6. The removal of timbers in the mines should not be permitted, except by specially designated employes and under the direct supervision of the foreman or one of his assistants. Post pullers should be used. The mine worker should stand by another set timber or other place of safety when pulling timbers.

7. In order that timbering may be properly and securely done, and that all loose slate may be pulled down, each employe who engages in this class of work should be provided with an axe and a slate bar. A slate bar should be required to be used in taking down slate—never a pick.

• *Special Rules for Pumpmen*

1. It should be the duty of the pumpmen to keep the pumps in their charge in good operating and safe condition for service and to see that they perform the work required of them; and they should be required to maintain neat and orderly surroundings at pump locations, keeping both clean and oily waste in receptacles provided for that purpose.

2. Insufficient power or low voltage should be required to be reported.

3. Ordinary repairs of pumps and pipes should be required to be made by the pumpman. Serious damage or breakage of pumps, or failure to keep the water within safe limits, should be required to be reported immediately to the mine foreman; and precautions should be taken against the loss of a pump through roof fall or drowning. All pumping equipment should be required to be stopped before attempting to repair, oil or grease it.

• *Special Rules for Track Layers*

1. Any person engaged in the occupation of trackman or helper, when working on haulageways traversed by mules or locomotives hauling cars should be required to give proper notice, by signal or in other required manner, that the track is being repaired, so that all movements of trips will approach that place slowly.

2. A track layer should not be permitted to leave track work unless he is satisfied that it is in a safe condition. Track tools should be kept in good condition and free from mushroomed heads. If work is not finished before completion of shifts, proper notice should be required.

3. Proper clearance (to be specified) should be required.

The rules shown here complete the series of tentative safety rules, covering general and special operations, that have been prepared by the Safety Committee and published in preceding issues of Mining Congress Journal.

\+ + +

• *Special Rules for Drillers*

1. Operators should not be permitted to wear loose or frayed clothing, and should be required to wear knit wrist gloves.

2. Operators should not be permitted to take hold of thread bar while drill is operating.

3. The operator should be required to be at the controller at all times when drill is running.

4. The cable should be reeled when moving the drill from one place to another.

5. Before moving the drill truck around a curve, the operator should make sure that the road is clear, and should also be required to line the track switch against the place into which the truck has been taken.

6. On trucks which are equipped with explosive containers, explosives should not be permitted to be removed from container while auger is being sharpened with emery wheel.

7. No place should be drilled until after being undercut, and the auger should be placed in the curve to get proper location and depth of drill hole.

8. Operators should be required to wear goggles when grinding augers.

9. Operators should be required to clean the holes with the auger while the drill is running.

10. Gathering locomotive cable should not be permitted to drag over truck when truck is being transferred. (This applies especially to trucks equipped with explosive's containers.)

11. No drilling should be permitted while the cutting machine is in operation.

• *Special Rules for Trappers*

1. Trappers should be required at all times to carry out the duties imposed upon them by the mine foreman, and they should not be permitted to ride on or tamper in any manner with passing cars, motors, machines or live stock without special permission from the mine foreman.

2. Doors should be opened by them in time for the passage of drivers or motor trips and then promptly and properly closed, and they should be required to take a safe position while trips are passing through.

3. Any defective or unsafe conditions should be required to be reported as soon as possible to the mine foreman or one of his assistants.

• *Special Rules for Outside Employes and Shopmen*

1. Motor or locomotive pits should be required to be kept covered or properly fenced when not in use.

2. Belt shifting with the hands should not be permitted.

3. In addition to the requirements of Rule 18, General Rules, goggles should be required to be worn by outside employes, shop men, etc., when grinding, pouring metal, working at a lathe or when engaged in any work in connection with which unprotected eyes may be subjected to injury, or when working around those engaged in such work. When engaged in electric welding or acetylene welding or cutting, proper protective equipment for the eyes, face and hands should be worn.

4. No one, unless authorized by the foreman in charge, should be permitted to ride on larries, cars, trucks, carts, wagons, or other vehicles, whether loaded or empty; the operator or driver should be held responsible for enforcement of this rule.

5. Railroad cars should not be permitted to be handled or placed for loading except by the regular car droppers or persons ordered to do so by the foreman in charge and under his direction. The number of cars dropped or handled at one time should not be more than can be easily controlled, and this number should be specified by the foreman. If the car brakes are found to be defective, aid should be secured before the cars are moved. Car droppers should wear safety belts while handling cars.

6. While engaged in dropping railroad cars into or out of the tipples every precaution should be required to be exercised to avoid injury by trains that may be shifting at or about the tipples or in the yards. Brakes should be required to be securely set on cars left standing.

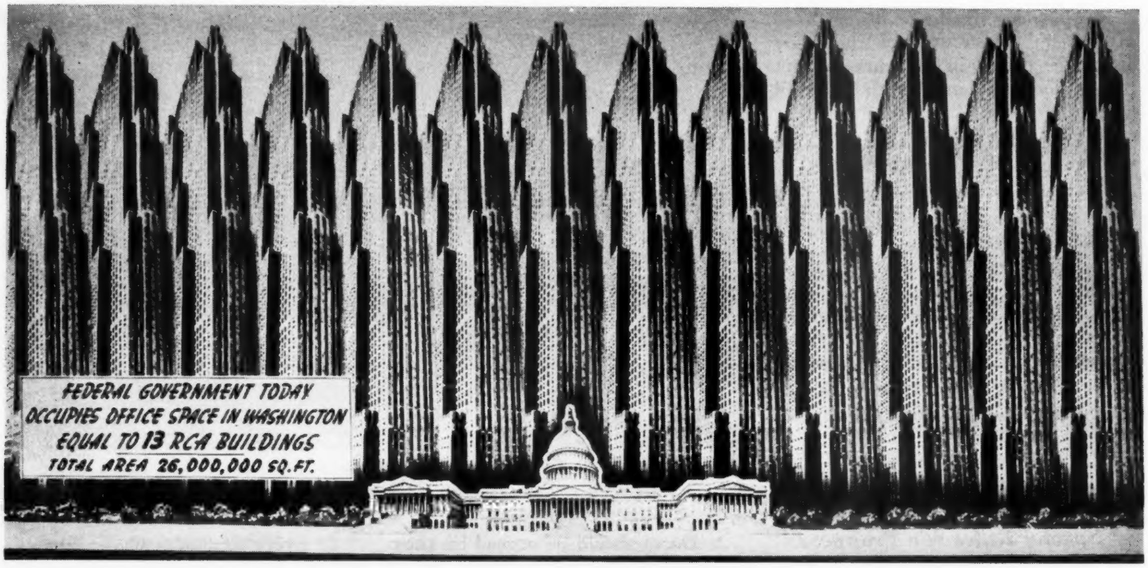
7. Power-house engineers, hoist engineers, head firemen in charge of boiler plants, and engineers or attendants in charge of other stationary engine rooms and washeries should be required to forbid all persons other than authorized employes such as mechanics, inspectors, or foremen, in the employ of the company, from entering the power-house or engine rooms, unless by permission of the superintendent.

8. Every employe whose duty involves the repair of electric driven machinery should be required to remove all electric connections from the power circuit to the part of the equipment to be examined before attempting examination or repair.

9. It should be the duty of every electrician, engineer, motorman, or any other employe having charge of the operation, repair, or supervision of machinery, movable or stationary, to report immediately to the attendant and the foreman or his assistant defects in machinery or safety appliances pertaining to them; and on finding or being informed that any machine is unsafe the foreman or his assistant should be required to make or have made immediate repairs of such defective machinery or parts of it. If such repairs cannot be made at the time, it should be the foreman's duty to stop operation of the machine or part of it until such defects are remedied and the machine made safe for operation.

10. No helper, motorman, engineer, or operator of any electric machine which has become impaired should be permitted to attempt to repair the defect if it is of a nature requiring the attention of the chief electrician or his assistant. This rule should apply to workmen who are competent to operate dangerous machinery but who may not have full knowledge of the mechanism of a machine or the conditions that caused it to become impaired or defective.

COAL IS DEFENSE



Pictogram courtesy United States News, Washington, D. C.

WHEELS OF GOVERNMENT

● As Viewed by A. W. Dickinson of the American Mining Congress

WHILE beehive activity continues in the offices of the War and Navy Departments and the Defense agencies, the limelight in these late winter days centers on the blare of debate in the Senate over the "Lease-Lend-to-Britain" bill. When the House of Representatives passed the bill by a vote of 265 to 160, the eventual enactment of the measure was pretty well foretold, but the opposition Senators have insisted upon time-consuming discussion, and the pronouncement of pro and con views fills the atmosphere in Washington to the practical exclusion of all else.

Handled as a routine matter, the House and Senate passed and the President has signed the authorization increasing the national debt limit to $65,000,000,000. In this connection, the Senate has now created a special budget committee which will endeavor to find means of balancing the budget. The members are Senators Tydings of Maryland, chairman, Thomas of Utah and Holman, a Republican, of Oregon.

Modifying the Excess Profits Tax

Arduous work of several weeks on the part of the Treasury and the Joint Committee on Internal Revenue Taxation, has resulted in an Excess Profits Tax Relief Bill which has been quickly passed by the House and Senate. This amendment to the Excess Profits Tax Act of 1940 embodies several features of value to corporations whose earnings fluctuate widely, as well as to those mining companies which during the base period years 1936 to 1939 were in the development stage.

An important feature of the amended law is the permission to carry over unused excess profits credit for two years; this now applies to all corporations regardless of size, whereas the law as passed last September allowed only a one-year carry over and was applicable only to corporations with earnings under $25,000.

Recognition of the principle of "normal growth" in business enterprise is given in the provision of an alternative method for the average earnings credit computation, which is helpful to corporations with heavier earnings in the last two years of the four-year base period.

Section 721 of the 1940 law as amended permits the "spreading" of income resulting from exploration and development over the years during which the development took place, and income thus allocated to years prior to 1940, is exempt from the Excess Profits Tax.

Section 722 of the 1940 Act was likewise amended to clarify and make specific the provisions under which relief may be granted where abnormalities exist in the base period income. A provision of particular interest to mining is that which permits a corporation, the character of whose business was different on January 1, 1940, from that existing in one or more years of the base period—for example, a mining corporation which passed from the development to the productive stage—to establish what the amount of its base period earnings would have been had the nature of its business at January 1, 1940, prevailed throughout the base period, and to use this amount in computing its excess profits credit. This should provide relief for many mining companies which could not otherwise establish any adequate basis for computing excess profits.

The Senate Finance Committee added a very important amendment which waives the requirement that the taxpayer must make a binding election on his returns as between the invested

capital basis and the average earnings basis for computing the excess profits credit. As the law is now written the taxpayer may make the computations on both bases and after audit and final determination by the Bureau of Internal Revenue the tax payable shall be the lesser tax. Many hundreds of mining taxpayers were in a serious dilemma under the 1940 law as they had no means of knowing what the determination of the Bureau of Internal Revenue would be and hence they simply did not know which basis to elect for the excess profits credit computation.

Failure on the part of a taxpayer to elect percentage depletion in its 1934 return was the subject of a ruling recently in the Third Circuit Court of Appeals which held that a percentage depletion allowance may be taken in the first taxable year in which the taxpayer could have deducted for depletion under either a cost or percentage basis. In the case of the Pittston-Duryea Coal Company handed down January 24, 1941, the court said: "Since the taxpayer in this case could not have had a deduction in 1934 under either method, it cannot be said to have made an election, which consists of a choice of alternatives. . . . It seems to us . . . the choice was to be made at a time when there could be a depletion allowance. The words 'first return' must be read in the light of these considerations and, so read, we think the reasonable meaning is that the taxpayer must make his choice in the first taxable year in which it could have a depletion allowance under one of the methods of computation." It is expected that the Commissioner will appeal this case.

The Committee on Ways and Means will hold hearings on Representative Patrick Boland's resolution to extend the life of the Guffey Coal Act for two years from April 26, 1941. There is a growing sentiment for limiting the extension to one year and for the appointment of a small Ways and Means Subcommittee to observe the administration of the Act.

Labor Strike Remedies

Stoppage and slowing down of defense production by industrial disputes caused murmurs of disapproval in the last session of Congress, and in the present session several members, notably straight-thinking Representative Howard W. Smith of Alexandria, Va., decided to do something about it. The House Committee on Judiciary has been holding hearings at which, among others, Director-General of the Office of Production Management William S. Knudsen has appeared. Later, on February 28, able Mr. Knudsen addressed a letter to Chairman Hatton Sumners (Texas) of the Judiciary Committee in which he proposed the following plan:

1. Disputes should be mediated by the Conciliation Service of the Department of Labor as at present.

2. In case of failure to settle the disputes, notice of strikes shall be given only after secret ballot supervised by the Labor Department with at least 60 per cent favoring the walk-out.

3. After notice of intent to strike the Office of Production Management shall have ten days to investigate and report. There shall be no strike until 30 days after the report is submitted.

Apparently Chairman Sumners' Committee is not considering any particular bill at this time but is merely sounding out the industrial dispute situation in preparation for action if and when needed.

Chairman Millis and Dr. Leiserson of the National Labor Relations Board are accomplishing procedural changes in the practices of their agency which are unquestionably an improvement over the experience of the past. The Review Division, guilty of many improprieties in months gone by, has been cut in half and is limited in its functions to the preparation of written case reviews. Memoranda prepared by this division will be compared with Trial Examiners' intermediate reports for the purpose of giving greater weight to the views expressed by the Trial Examiner. A new division has been set up to direct the work of the regional offices and to oversee the issuance of complaints and procedure in representation cases; also Regional Coordinators are to supervise regional organizations. In handling personnel, promotion from within the Board's staff will be stressed and efforts will be directed toward the building up of a thoroughly trained field staff and the placing of greater responsibility upon the Regional Directors. The Office of the Executive Secretary is reduced to routine duties, and other duties which it had assumed in the past are decentralized.

House Gets Flannery Bill

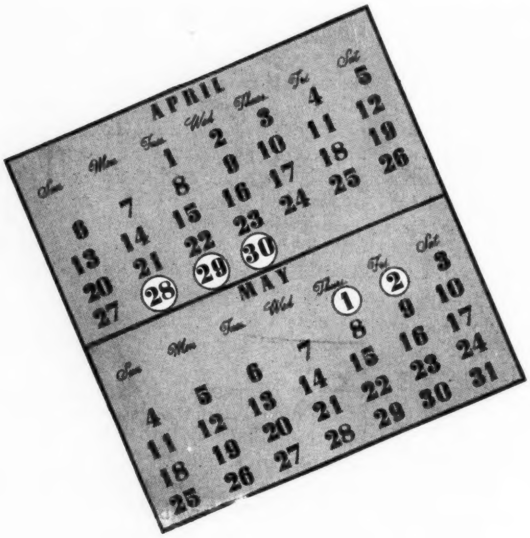
On February 20 the Flannery bill, sponsored by the U. M. W. of A., providing for Federal inspections of coal mines, was ordered reported to the House of Representatives. As the bill now goes to the Rules Committee, it provides that inspections shall be made through the U. S. Bureau of Mines and that "in the selection of persons for appointment as coal mine inspectors any inspector employed shall be an accredited engineer or the equivalent thereto with the basic qualification of five years' practical experience in the mining of coal." Remaining in the bill are the provisions requiring an inspection upon submission of a petition signed by a majority of the underground workers in a mine, or signed by the authorized employe representatives of a majority of the underground workers, or signed by the collective-bargaining representative of a majority of the underground workers.

The bill is now before the Rules Committee with the prospect that it will soon be reported and be subject to action on the House floor.

Now the Walter-Hatch Bill

Hearings will begin on March 31 when a Senate Judiciary Subcommittee will consider three bills similar to the Walter-Logan bill of last year, to curb the administrative procedure of Federal agencies and to provide for judicial review in District Courts of decisions rendered by the administrative bodies. The Senate Subcommittee is composed of Senators Hatch of New Mexico, chairman; O'Mahoney of Wyoming, Chandler of Kentucky, Austin of Vermont and Danaher of Connecticut. In the House, although a hearing date has not been set, the new Walter bill which is sponsored by the American Bar Association, will be considered by another Judiciary Subcommittee consisting of Representatives Bryson of South Carolina, chairman; Thom of Ohio, Gwynne of Iowa and Vreeland of New Jersey. The bills contain provisions for declaratory or advisory opinions to be granted by the courts where grave injury might be caused by the ruling of an administrative agency.

Consideration of the whole subject is the outgrowth of the situation which arose over the Walter-Logan bill of the last session of Congress, when the bill was killed by a Presidential veto, and of the report of the Attorney-General's Committee on Administrative Procedure which rendered its report in January of the present year.



The Coal Show Is Coming

THE multitude of those who have attended previous annual conventions and expositions need not be told that the forthcoming Coal Show at Music Hall in Cincinnati, on April 28 to May 2, inclusive, will have absorbing sessions devoted to discussions of pressing problems of the industry; that manufacturers will have their best foot forward with a display of all equipment that is new and interesting; and that there will be entertainments to suit everyone. The week is jam-packed with features and entertainment.

It need only be said that greater interest is being shown this year than ever before. Exhibit space is at a premium; meeting defense needs has faced operating men with new problems; entertainment is being planned on a lavish scale. The keynote of the Show will be "Coal Is Defense," for the powerful impulse given by coal extends over all industry, and is especially necessary at this time. All indications point to a record-breaking attendance. Secure your hotel accommodations early.

Advance Program

The program of the operating sessions is practically completed, as shown in the preliminary announcement here given. Only a few gaps remain to be filled in. Live and pressing problems have been selected as subjects and well-informed speakers will discuss each. The opening session on Monday morning will keynote the convention with papers on safety and the relation of coal to the defense program; and further safety discussions will be presented throughout the week in specific relation to the various phases of mining considered. Mechanical mining will be the principal topic for the sessions on Monday, Tuesday and Wednesday afternoons, starting first with mobile loading machines, then presenting aspects of mechanical mining that apply to all types of mechanization and continuing with the subject of conveyors on Wednesday afternoon. Wednesday morning will be devoted to problems of surface preparation, and the Thursday sessions will be of special interest in presenting the important questions of management, education, compara-

Meeting of the Entertainment Committee in Cincinnati on February 11, completing arrangements for Convention Week. J. H. Fulford, Chairman

— Preliminary Program —

MONDAY, APRIL 28

MORNING SESSION

Opening of Convention

1. **Coal and National Defense**
   Speaker to be announced
2. **Certain Aspects of Coal Mine Safety**
   EUGENE McAULIFFE, Pres., Union Pacific Coal Co.

AFTERNOON SESSION

1. **Rubber-tired Shuttle Haulage With Mechanical Loading**
   LLOYD ANDERSON, Supt., Peabody Coal Co.
2. **Transfer Cars With Track Mounted Loading Machines**
   DAVID W. JONES, Gen. Supt., Princeton Mining Co.
3. **Auxiliary Face Operations**
   A. E. DUCKWALL, Chf. Engr., U. S. Coal & Coke Co.

TUESDAY, APRIL 29

MORNING SESSION

1. **Mechanical and Electrical Maintenance**
   Speaker to be announced
2. **Lubrication for Mining Equipment**
   HAROLD S. LOWRY, Chf. Engr., Snow Hill Coal Corp.
3. **"Information—We Hope"**
   A Panel of Operating Experts

AFTERNOON SESSION

1. **Power Distribution for Mechanical Loaders and Conveyors**
   R. L. KINGSLAND, Elec. Maint. Engr., Consolidation Coal Co.
2. **Underground Operation With Drag Line Conveyor**
   A. FRED PHELPS, Supt., Pardee & Curtin Lumber Co.
3. **Safety Methods for Mechanical Loaders and Conveyors**
   R. H. NICHOLAS, Chf. Mine Insp., Pittsburgh Coal Co.

WEDNESDAY, APRIL 30

MORNING SESSION

1. **Economics of Dewatering Fine Coal**
   C. J. POTTER, Rochester & Pittsburgh Coal Co.
2. **Preparation of Stoker Coals—Economic Factors Involved**
   JACK H. PRICE, Coal Sales Mgr., Stearns Coal & Lumber Co.
3. **Cleaning Fine Coal Below Stoker Sizes**
   Virgil Cargile, Gen. Supt., Tenn. Products Corp.

AFTERNOON SESSION

1. **Conveyor Mining Methods in Alabama**
   F. J. IMMLER, Asst. Chf. Engr., Ala. By-Products Corp.
2. **Requirements for Successful Duckbill Mechanical Loading**
   S. W. BLAKSLEE, Gen. Mgr., Powhatan Mining Co.
3. **Economics of Gathering Belts with Mechanized Mining**
   CAREL ROBINSON, Cons. Mng. Engr., Charleston, W. Va.

THURSDAY, MAY 1

MORNING SESSION

1. **Management, Supervision and Personnel Problems**
   JAMES HYSLOP, Gen. Mgr., Hanna Coal Co.
2. **Vocational Training and Education**
   T. J. THOMAS, Pres., Valier Coal Co.
3. **"Information—We Hope"**
   A Panel of Operating Experts

AFTERNOON SESSION

1. **Federal Regulations**
   Speaker to be announced
2. **Causes and Prevention of Mine Roof Deterioration**
   H. B. McNARY, Cons. Engr., The New River Co.
3. **Need and Use of Altimeter Surveys in Mine Ventilation**
   STEPHEN KRICKOVIC, Gen. Mine. Insp., Koppers Coal Co.

SPECIAL COAL STRIPPING SESSIONS

TUESDAY AFTERNOON

1. **Exploration for Coal Stripping**
   Speaker to be announced
2. **Overburden Preparation—Methods and Equipment**
   CARL WALKER, Ayrshire-Patoka Collieries Corp.
3. **Planning and Working Smaller Strip Operations**
   F. R. PHILLIPPI, Dye Coal Co.

WEDNESDAY AFTERNOON

1. **Hydraulic Application to Coal Stripping**
   R. E. HENDERSON, Gen. Supt., Pyramid Coal Corp.
2. **Strip Mine Haulage—Types, Methods and Roads**
   ERIC E. LAURELL, United Electric Coal Cos.
3. **Strip Mine Maintenance—Approved Practices**
   GEO. E. NETTELS, Gen. Supt., Pittsburg & Midway Coal Mining Co.

---

tively new methods of roof support, ventilation surveys, and federal regulation. The special coal stripping sessions on Tuesday and Wednesday afternoons will cover the most modern phases of operation in this branch of the industry. Haulage, equipment maintenance and over-burden will be discussed as applying to both large and small operations.

The new feature, "Information—We Hope," will be inaugurated on Tuesday morning, with a second session on Thursday morning. As previously announced, questions on mining problems will be submitted to a panel of operating experts; these questions will be requested from the industry in advance of the convention, and everyone is invited to present his problems.

The importance of coal in national defense, the dependence of the entire defense program on an ade-

quate fuel supply, and the vital need of adequate machinery and replacements will be among the subjects discussed by men who are well qualified to set forth the problems and to suggest the best ways to meet them.

Exposition

The three floors of Music Hall will be fully occupied with exhibits of machines, equipment and supplies—all destined to play their part in production for defense needs. Coal is rolling away from the mining plants in increasing volume, and the exposition this year gives the operating man a most opportune view of new equipment he may need to keep the coal rolling. Displays will run the gamut of equipment needs from the working face to the railroad car. Each exhibitor will have displays and attendants to help you and give you information. Among the exhibitors listed here will be found one or more to supply any mining item:

Exhibitors

Ahlberg Bearing Co.
Air Reduction Sales Co.
Allis-Chalmers Mfg. Co.
Allis Co., The Louis
American Brattice Cloth Corp.
American Bridge Co.
American Cable Division
Hazard Wire Rope Division
American Car & Foundry Co.
American Chain & Cable Co., Inc.
American Cyanamid & Chemical Corp.
American Steel & Wire Co.
Anaconda Wire & Cable Co.
Atlas Powder Co.
Barber-Greene Co.
Bemis Bro. Bag Co.
Bethlehem Steel Co.
Bixby-Zimmer Engineering Co.
Bowdil Co., The
Broderick & Bascom Rope Co.
Brown-Fayro Co., The
Bucyrus-Erie Co.
Cardox Corporation
Carnegie-Illinois Steel Corp.
Central Electric Repair Co.
Centrifugal & Mechanical Industries, Inc.
Chicago Pneumatic Tool Co.
Cincinnati Mine Machinery Co.
Cities Service Oil Co.
Coffing Hoist Co.
Deister Concentrator Co., The
Deister Machine Co.
Deming Co., The
Differential Steel Car Co.
Duff-Norton Mfg. Co., The
Du Pont de Nemours & Co., Inc., E. I.
Dustlix Corporation
Edison, Inc., Thomas A.
Electric Railway Equipment Co., The
Electric Railway Improvement Co., The
Electric Storage Battery Co.
Enterprise Wheel & Car Corp.
Fairmont Machinery Co.
Flocker & Co., John
Flood City Brass & Electric Co.
General Electric Co.
Gibraltar Equipment & Mfg. Co.
Goodman Manufacturing Co.
Gorman-Rupp Co., The
Gould Storage Battery Corp.
Gulf Oil Corp.
Guyan Machinery Co.
Haynes Stellite Co.
Hendrick Mfg. Co.
Hercules Powder Co.
Hulburt Oil & Grease Co.
I-T-E Circuit Breaker Co.
Jeffrey Mfg. Co., The
Johnson-March Corp.
Joy Manufacturing Co.
King Powder Co., The
Koppers Company
La-Del Conveyor & Mfg. Co.
Lee-Norse Co.
Leschen & Sons Rope Co., A.
Leyman Mfg. Co.
Linde Air Products Co.
Link-Belt Co.
Locke Stove Co.
McGraw-Hill Publishing Co., Inc.
McLanahan & Stone Corp.
McNally-Pittsburg Mfg. Corp., The
Mack-International Motor Truck Corp.
Macwhyte Company
Mancha Storage Battery Locomotive Co.
Marion Steam Shovel Co.
Markham Products Co.
Mechanization, Inc.
Metal & Thermit Corp.
Miners' Exhibit
Mine Safety Appliances Co.
Mines Equipment Co.
Mining Congress Journal.
Mining Machine Parts, Inc.
Myers-Whaley Co.
Nail City Bronze Co.
National Carbide Corporation
National Carbon Co., Inc., Carbon Sales Div.
National Electric Coil Co.
National Malleable & Steel Castings Co.
National Tube Co.
Nordberg Mfg. Co.
Ohio Brass Co.
Ohio Carbon Co., The
Osmose Wood Preserving Co. of America, Inc.
Owens-Corning Fiberglas Corp.
Penn Machine Co.
Pennsylvania Electric Coil Corp.
Philco Corp., Storage Battery Div.
Portable Lamp & Equipment Co.
Post-Glover Electric Co., The
Productive Equipment Co.
Prox Co., Inc., Frank
Pure Oil Co., The
Reliance Electric & Engineering Co.
Roberts & Schaefer Co.
Robins Conveying Belt Co.
Roebling's Sons Co., John A.
Rome Cable Corp.
Safety First Supply Co.
Sanford Day Iron Works, Inc.
Scully Steel Products Co.
Simplicity Engineering Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stephens-Adamson Mfg. Co.
Sullivan Mchinery Co.
Sun Oil Co.
Talcott, Inc., W. O. & M. W.
Tamping Bag Co., The
Templeton, Kenly & Co.
Tennessee Coal, Iron & Railroad Co.
Tide Water Associated Oil Co.
Timken Roller Bearing Co.
Tool Steel Gear & Pinion Co.
Trabon Engineering Co.
Tyler Co., The W. S.
Union Carbide Co.
Union Wire Rope Corp.
United Engineers & Constructors, Inc.
U. S. Bureau of Mines
U. S. Rubber Co.
U. S. Steel Corporation Subsidiaries
Viking Mfg. Co.
Watt Car & Wheel Co., The
Weir Kilby Corp.
Western Cartridge Co.
Westinghouse Elec. & Mfg. Co.
West Virginia Rail Co.
Wheat Lamp Sales, Inc.
Wilson Welder & Metals Co., Inc.
Wood Preserving Corporation.

Entertainment

After every day's sessions there will come the evenings, to be devoted to the lighter side of things. The enthusiasm and attendance of past years attests to the men's enjoyment of this phase of the meeting.

Stellar features this year will be the conviviality and entertainment at the King Coal Club, in the Pavillon Caprice of the Netherland Plaza Hotel, on Monday, Tuesday and Wednesday nights, April 28, 29 and 30. Dinner will begin at 6, to be followed by a sparkling floor show. Your friends will be there. On Tuesday evening the dinner will be followed by another of the tremendously popular boxing tourneys, after the pattern of last year.

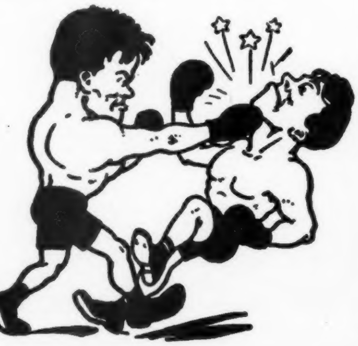
The climax of the week will be the banquet on Thursday evening, May 1. No speeches, but good food and a good time, in the Hall of Mirrors at the Hotel.

COAL SHOW BOXING TOURNEY

NETHERLAND PLAZA HOTEL, CINCINNATI, OHIO— APRIL 30

Open to A.A.U. members only. Handsome prizes to the winners, and a free trip to Cincinnati for all participants.

Address the American Mining Congress, Munsey Building, Washington, D. C., for further information and entry blanks.



THE Big 3

TOM the TRACKMAN:

So that's the drill you're braggin' on.
Does that contraption crawl, or run?

DUKE the DRILLER:

Just line them switches for the straight
And I'll show you my trammin' rate.

29U CUTTER

FAST, EASY TRAMMING MEANS MORE AND CHEAPER TONS

THE JEFFREY MFG. CO.
COLUMBUS, OHIO

L 400 LOADER

Licensed under the patents of E. C. Morgan, Patents Nos. 1705961, 1705962, 1707132, 1707133, 1953325, and 1953326.

PERSONALS

Charles F. Jackson, chief engineer of the mining division, U. S. Bureau of Mines, Washington, D. C., and **Paul T. Allsman**, engineer in charge of the mining division of the Bureau's Salt Lake station, recently inspected operations testing for manganese in Utah. Mr. Jackson was on an extensive Western inspection tour of strategic mineral projects.

Herman C. Bellinger, vice president in charge of operations for the Chile Exploration Company, subsidiary of Anaconda Copper Mining Company, was the recipient of the William Lawrence Saunders Gold Medal for 1941, for achievement in mining, at the recent annual meeting of the A. I. M. E. in New York.

V. P. Ahearn of Washington has been elected secretary of the Board of Trustees of Air Hygiene Foundation of America, Inc. At the same time **Theodore C. Waters** of Baltimore was elected to the Board as general counsel, and **John F. McMahon** was promoted to the position of executive secretary.

F. H. Hull, formerly acting superintendent of the Toms Creek Mine of the Virginia Iron, Coal and Coke Co., Roanoke, Va., has been appointed superintendent of the same property, assuming his duties the middle of February.

S. E. Hackett, president of the Baton Coal Company, Pittsburgh, Pa., resigned in February to act as consultant to the steel unit of the Materials Branch of the Office of Production Management. Mr. Hackett was formerly president of the Jones & Laughlin Steel Corporation of Pittsburgh. In his new position Mr. Hackett will be a dollar-a-year man in government service.

Dean F. Frasche, Chief, Geological Survey Division, Philippine Bureau of Mines, is in the United States on leave, in connection with the study of manganese and chromite deposits of the Philippines. He recently inspected the manganese deposits of Cuba.

A. H. Burroughs, Jr., of Boise, Idaho, was elected president of the Idaho Mining Association for 1941, succeeding I. E. Rockwell of Bellevue. Mr. Burroughs is president of Talache Mines, Inc., and of the Custer Consolidated Mines, both in southern Idaho.

Warren N. Cuddy, a prominent attorney of Anchorage, Alaska, recently visited the offices of the American Mining Congress in Washington, on a trip to the east.

R. A. McCarty, manager of the steam division of Westinghouse Electric and Manufacturing Company, has been made a vice president of the company. Other promotions to vice presidencies include **Bonnell W. Clark** of New York, president of Westinghouse Electric Supply Company; **Frank D. Newberry** of Pittsburgh, manager of the company's emergency products division; and **A. C. Streamer**, general manager of the company's East Pittsburgh division.

Leverett Davis of Salt Lake City has joined the staff of the Callahan Zinc-Lead Company as field engineer. Mr. Davis has operated mines in Oregon, Washington, Idaho and Alaska, and he recently established offices in Salt Lake City.

William G. Snyder was elected president of Keystone Mines, Amador City, Calif., at the annual meeting of the company.

Ira B. Joralemon, well known consulting engineer and economic geologist of San Francisco, has been made a director of the American Institute of Mining and Metallurgical Engineers.

Dr. H. E. Culver, supervisor of the Washington State Division of Geology, was elected chairman for 1941 of the Columbia section of the A. I. M. E.

L. C. Campbell, assistant to the vice president of the Koppers Coal Company, has been appointed general manager of mines of the same company. Mr. Campbell will have full charge of all mining operations and will continue to make his headquarters in Pittsburgh. **H. John Harper**, formerly project engineer with the company, has been made assistant to the general manager of mines.

Dr. Tracy C. Jarrett, formerly assistant metallurgist with the American Optical Company, has been appointed chief metallurgist for Koppers Company, American Hammered Piston Ring Division, Baltimore, Md. He assumed his new duties in February.

Marion Sansom has been made metallurgist and mill foreman of the 50-ton mill of the Western Molybdenum Corporation at Chewelah, Wash.

Roswell W. Prouty, expert on strategic minerals investigation with the U. S. Bureau of Mines, left Miami by Pan American on February 22 for Caracas, Venezuela, to conduct studies of strategic minerals deposits in Venezuela, Colombia and Central American states. It is expected that his work will be completed in the early summer. Mr. Prouty, formerly a consulting geologist of Los Angeles, joined the staff of the Bureau of Mines last fall.

C. I. MacGuffie was appointed on February 28 as manager of sales, electric welding section, of the General Electric Company, succeeding L. D. Meeker, who is now associated with the Smith-Meeker Engineering Co., New York City.

G. E. Hoover on February 1 was appointed assistant to engineer of coal properties of the Chesapeake and Ohio Railway Company, with headquarters at Huntington, W. Va. Mr. Hoover replaces **H. B. Husband**, who has resigned.

F. H. Lindus, formerly branch manager in charge of the service-sales division of the Timken Roller Bearing Company in Los Angeles, has been transferred to the home office at Canton, Ohio, where he will engage in sales promotional work.

G. A. Brady, formerly research assistant, Mineral Industries School of the Pennsylvania State College has been placed in charge of that division. Mr. Brady is a graduate of the University of Iowa and the University of North Dakota, and received his Ph.D. in fuel technology at Pennsylvania State College.

John V. N. Dorr, president of the Dorr Company, New York, received in January the Perkin Medal, highest award in the chemical profession. This award was established in 1906 in honor of the late Sir William Perkin and is presented for outstanding achievement in the application of chemistry to industry.

John C. Cosgrove, mining engineer, Johnstown, Pa., and president of Bituminous Coal Research, Inc., will deliver the annual Markle lecture at Lafayette College, Easton, Pa., on March 26. His subject will be "In the Wake of a Travelling Engineer." Several reels of colored film taken by Mr. Cosgrove on a recent world tour will be used to illustrate the lecture.

Robert M. Medill of Springfield has been appointed by Governor Green Director of Mines and Minerals for Illinois. Mr. Medill resumed the office which he had held under two previous Governors, Lowden and Small.

J. W. Gardner, chairman of the Executive Committee of the Board of Directors of the Gardner-Denver Co., was presented by his associates with a watch charm in the form of a gold diamond-set model of a steam governor, as a mark of esteem on completion of 60 years' service with the Gardner-Denver Company.

G. A. Joslin, Los Angeles, has been elected head of the Mining Association of the southwest for the year 1941. He succeeds **E. O. Slater** who retires to return to the chairmanship of the mining committee of the Los Angeles Chamber of Commerce. Other association officers chosen at the same time were: **Howard Kegley**, first vice president; **Robert Linton**, second vice president; **Victor Hayek**, secretary-treasurer.

H. A. Glover was appointed vice president in charge of sales of the Island Creek Coal Sales Co., effective January 1. He was formerly assistant to the president.

Elmer C. Lusk has joined the technical staff of Battelle Memorial Institute, Columbus, Ohio. He will assist in the various investigations on ore dressing and coal preparation in progress at the Battelle Laboratory.

Carl A. Rockwood of Phoenix, Ariz., has been appointed receiver for Congress Mining Corporation at Congress, Ariz., where the 300-ton cyanide plant is continuing to operate on the tailing and dump ore from the old Congress mine. **W. A. Ledell** is in charge at the property. Receivership was established for failure to repay an RFC loan granted in 1937.

William G. Snyder of Jackson, Calif., has been elected president of Keystone mine at the annual meeting of the stockholders held in Jackson. **C. L. Culbert**, Amador City, was elected secretary. **T. S. O'Brien** is superintendent of the mine at Amador City.

William T. Hopkins, St. Paul, Minn., is the new sales representative of the Consolidated Coal Company in the Northwest, succeeding the late W. J. Howard.

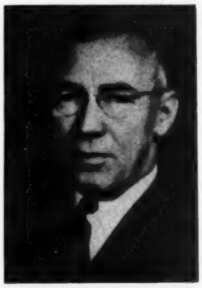
Eugene McAuliffe, president of the Union Pacific Coal Company, will address the Southeast section of the A. I. M. E. at Birmingham, Ala., on March 6. His subject will be on the theme of safety in coal production.

William F. Boericke, Chief of the Valuation Division of the Bureau of Mines, Manila, P. I., was recently in New York and Washington on leave. He is returning to the Philippine Islands soon to resume his work with the Bureau.

Harry J. Schultz has been appointed central regional manager of the Construction Equipment Division of Worthington Pump and Machinery Corp., with headquarters in the Daily News Building, Chicago, Ill. He was formerly manager of the Contractor's Division of the Independent Pneumatic Tool Co. **M. P. Robinson** has joined the same company as head of the corporation's newly organized Water Purification Equipment Division.

Harry F. Reinhardt, F. A. Sterner and **Charles J. Chervanik**, recently incorporated in Harrisburg, Pa., the Bear Valley Sales Corporation, the announced purpose of which is to engage in surface and underground mining and sales of coal. The three incorporators have extensive leases on coal lands, formerly a part of the Bear Valley Collieries, and will engage in a major stripping operation.

Ernest C. Low on March 1 assumed his new duties as general manager of sales for the John A. Roebling's Sons Company of Trenton, N. J. His last position was as president and general manager of the John A. Roebling's Sons Company of California. His headquarters are now in Trenton.



William G. Duncan, Jr., has been promoted from superintendent to the position of vice president and general manager of the W. G. Duncan Coal Company in Greenville, Ky.

J. H. Bell has been promoted to the position of executive vice president of the Cardox Corporation, Chicago, and will also be in charge of mining activities. Other recent promotions in the company are: **Eric Geertz**, to vice president in charge of the fire division; **Harry Ensminger**, to general sales manager of the same division; **Lawrence E. Lawson** was promoted to vice president of the carbon dioxide gas division, and **Dr. C. A. Getz**, to Director of Research.

B. R. Bates has returned to New York, concluding two years' service in the Philippine Islands with the Masbate Consolidated Mining Company.

Arthur B. Shutts has been made president of the Jones Coal Corporation in Middleport, Pa. He was formerly with the Kehoe Berge Coal Company in Pittston, Pa.

J. Q. Blades, Western representative for the Ingersoll-Rand Company, has moved his headquarters from San Francisco to Reno, Nev.

T. W. Bacchus, vice president and director of the Hercules Powder Company since the company's incorporation in 1912, has resigned, effective February 1.

Joseph R. Guiteras, mineral specialist with the U. S. Bureau of Mines, has been assigned to duty in Chile for technical work designed to expand the output of strategic minerals from Latin American sources. **William F. Jahn**, another specialist, has been sent to Argentina for the same purpose, and **William O. Vanderburg** to Peru. One or more mining specialists of the Bureau of Mines are yet to be assigned to other South American countries.

J. T. MacBain, assistant works manager of Union Carbide Company and Electro Metallurgical Company, accompanied by **L. H. Davis**, consulting engineer, **C. H. Bracket**, electrical engineer, and **D. C. Duncan** of the operating division of the same companies recently made an inspection trip on the west coast to select a location for a combined carbide and ferro alloy plant to be built immediately.

Raymond T. Middleton, manager of the Mining Department Sales, Pittsburgh District, has been elected a director of Roberts and Schaefer Company.

Fred J. Hoff is employed by the Cotopaxi Exploration Company, Ecuador. He recently left the Climax Molybdenum Company of Colorado.

James McNaughton, president of Calumet and Hecla Consolidated Copper Company, Calumet, Mich., has tendered his resignation to take effect April 15, because of ill health.

Rene Engel, consulting engineer of California, has joined the staff of Marsman and Company, Inc., in Manila.

William B. Plank, head of the Mining Department, Lafayette College, has been appointed a member of the governing board of the Engineers' Council for Professional Development.

Samuel P. Moyer is assistant metallurgist for the Bureau of Mines at Salt Lake City. He was formerly engineer and mill superintendent for Kern Mines, Inc., at Kernville, Calif.

— *Obituaries* —

Albert Beardsley Jessup, a leading anthracite mining engineer and coal company executive, died at his home

in Waverly, Pa., on January 25 following a long illness.

For many years Mr. Jessup was active as vice president and general manager of the John Markle interests, including the Jeddo-Highland Coal Company and the Jeddo Tunnel Company. He retired in 1937 to private practice after completing 25 years of service with these companies.

Mr. Jessup throughout his long career as a mining expert was interested in labor matters connected with the anthracite industry. He served on the Anthracite Operators' Wage Negotiating Committees in 1923 and again in 1933. He was often in demand in other negotiations in a technical capacity. He represented various mining groups for the Interstate Commerce Commission and at Senate investigations, and served as a fuel administrator during the World War and also as a member of the NRA code committee of the industry.

Edward Alexander Hamilton, long active in mining in the West died on

February 26 in Salt Lake City, at the age of 62 years. He suffered a heart attack while being treated for a foot injury.

Mr. Hamilton was general manager of mines in charge of all western operations of the United States Smelting and Refining Company, and had been with this company since 1912. From 1918 to 1924 he was superintendent of the mine at Bingham, Utah, and since assumed the position he held at the time of his death.

He had served as chairman of the Board of Governors of the Western Division of the American Mining Congress; he was past chairman of the Utah Section of the American Institute of Mining and Metallurgical Engineers.

Surviving are his wife, Lois Gafney Hamilton, and a daughter, Mrs. James Bell, of Tracy, Calif.

John T. Ryan Passes On

John T. Ryan, president of the Mine Safety Appliances Company, Pittsburgh, died February 20 of a heart attack in Miami, Fla., at the age of 57. His death comes as a great shock to his innumerable friends. He was one of the widest-known, well-liked, hard-working and jovial men in the entire mining industry.

Mr. Ryan was born in Huntingdon County, Pennsylvania. He attended Junaitia College and the Pennsylvania State College, from which he was graduated in 1908 with a degree of B.S. in mining engineering. He was given the degree of Honorary Engineer of Mines by the latter college in 1934.

During his entire business life he was actively identified with the mining industry. After graduation he became affiliated with the Rocky Ridge Coal Company and later was superintendent and mining engineer for the Langdon Coal Company of Huntington, Pa. From 1911 to 1914 he was in charge of the mine rescue and safety and mine lamp testing division of the United States Bureau of Mines. In 1914, seeing the need for more adequate safety equipment, he and George H. Deike, of Pittsburgh, founded the Mine Safety Appliances Company, which today is the largest manufacturer of mining and industrial safety equipment in the world.

In 1915 Mr. Ryan worked with Thomas A. Edison in the inventor's laboratory at West Orange, N. J., on the design and development of the Edison cap lamp, which has since become widely used in mines throughout the world. In December, 1940, he was made an honorary member of the Edison "Old Timers' Club," comprised of the men who worked with Thomas Edison in his early years.

Mr. Ryan was a member of the Board of Governors of the Manufacturers Division of the American Mining Congress. He was also a

member of the American Institute of Mining and Metallurgical Engineers (past chairman of the Coal Division), the Canadian Mining Institute, the Coal Mining Institute of America, the Pittsburgh Coal Mining Institute, the Western Pennsylvania Engineers Society, the Illinois Mining Institute, the West Virginia Mining Institute, the Rocky Mountain Coal Mining Institute, and a charter member of the National Mine Rescue Association. He belonged to the Duquesne Club, the Long Vue Country Club, the Pittsburgh Athletic Association and the Sigma Gamma Epsilon Mining Fraternity.

The funeral was held from St. Paul's Cathedral, Pittsburgh, on February 25. Indicative of the high esteem accorded Mr. Ryan, his funeral was attended by men from all branches of the industry, and included in the honorary pallbearers were some of those most prominent in the country.

Surviving him are his widow, Mrs. Mary Gavin Ryan; a son, John T. Ryan, Jr.; and two sisters, Miss Ella A. Ryan and Mrs. H. J. McCarthy, all of Pittsburgh.

Matthew Van Siclen, chief engineer of the Coal Economics Division, U. S. Bureau of Mines, died at Tucson, Ariz., on March 3, at the age of 60 years. The funeral was held in Tucson on March 5 and his ashes interned in Arlington National Cemetery.

Mr. Van Siclen first joined the Bureau in 1919, in the work of the War Minerals Relief Commission. He was subsequently chief engineer of the Mining Research Division, resigning in 1926 to engage in private consulting practice. In 1933 to 1935 he was consulting engineer for the Turkish Government.

Charles H. Goodsell, mining engineer of Spokane, Wash., died December 25 in Spokane at the age of 62.

NEWS and VIEWS

Wage-Hour Conference on Leasing Systems in Metal Mines to Be Held At Salt Lake City

An informal fact-finding conference on leasing systems in the metal-mining industry will be held March 18, at Salt Lake City, Colonel Philip B. Fleming, Administrator of the Wage and Hour Division, U. S. Department of Labor, has announced. The conference is to meet in the Chamber of the Utah House of Representatives and will be held before Dorothy M. Williams, Regional Attorney for the Division in San Francisco.

The conference is to consider the question of whether lessees of mine operators are employes under the Fair Labor Standards Act. An opinion on this question was expressed by Colonel Fleming in July, 1940, at the request of metal mine operators and lessees of such operators in the intermountain states. Colonel Fleming stated that if under the lease agreement control and supervision over the operations of the so-called lessee are reserved to the lessor, such lease agreement embodies the normal incidents of the employer-employe relationship, and the so-called lessees will be considered as employes under the Fair Labor Standards Act. On the other hand, Colonel Fleming further stated, if a particular lessee is operating mining property which is not a part of the property currently being operated by the mining company with regular employes, and if in the lease agreement the mining company does not have the right to control the lessee in his operation of the mining property, it may well be that the lessee is not an employe of the mine owner but is in fact an independent operator of such property.

At the conclusion of the conference the Administrator will announce a further interpretation on the question of the existence of the employer-employe relationship between mine operators and so-called mining lessees. The conference will also assist the Administrator in making other related determinations concerning the application of the Fair Labor Standards Act to mines operating partially or wholly under a leasing system.

A record will be made of the testimony presented and will be available for purchase. After the conference a reasonable time will be allowed for the filing of briefs.

Any interpretation announced by the Administrator as a result of this conference will serve merely to indicate the construction of the law which will guide the Administrator in his enforcement of the Act. However, it should be noted that the Supreme Court has announced, in the case of U. S. v. American Trucking Associations, Inc., et al, that the Administrator's interpretative opinions covering the Fair Labor Standards Act are entitled to great weight.

Smelter Constructed

The Cobalt Gold Mining Company has almost completed construction of a smelter capable of treating 150 tons of ore a day. The smelter is located at Degge Lake, four miles north of Boulder, Colo., and will treat cobalt, gold, nickel, silver ore from the property of the company, located 14 miles west of Boulder.

The plant has roll crushers, and a Dwight Lloyd sintering plant with a capacity of 60 to 70 tons a day. The furnace has a capacity of 100 to 150 tons per day. The power plant consists of two diesel units of 131 hp. each, connected to 100 k.w. three-phase generators. Henry J. Von Wyl is president of the company.

Advisory Committee For the Bituminous Coal Division

Representatives of coal producers and coal mine employes have been appointed by Secretary of Interior Ickes to constitute an Advisory Committee to the Bituminous Coal Division. The order designating the committee provided that its functions "shall be to advise the Director of the Bituminous Coal Division and the Secretary of the Interior with respect to matters of general policy arising in connection with the administration of the Bituminous Coal Act of 1937." On the committee representing producers in the industry are: George W. Reed, Chicago, vice president, Peabody Coal Company; C. E. Mahan, Knoxville, Tenn., chairman of the board, Southern Coal and Coke Company; L. E. Woods, Huntington, W. Va., president of the Crystal Block Coal and Coke Company and chairman of the Bituminous Coal Producers' Board for District 8; Douglas Millard, Denver,

CARLTON DRAINAGE TUNNEL STRIKES WATER

The chief objective of the Carlton Drainage tunnel, Cripple Creek, Colo., was struck on February 20, at a distance of 29,000 feet from the portal, when the Newmarket fault was reached, and a water flow of 20,000 g.p.m. soon developed.

Above: John Austin, superintendent, inspects the tunnel, after work was stopped, until the flow would diminish. The Ajax mine is being drained rapidly

manager of sales, fuel and by-products division, Colorado Fuel and Iron Corporation and chairman of the Bituminous Coal Producers' Board for District 17; and Charles O'Neill, New York, president of the United Eastern Coal Sales Corporation and chairman of the Bituminous Coal Producers' Board for District 1. The committee representing employes are: Thomas Kennedy, Washington, D. C., secretary-treasurer, United Mine Workers of America; A. D. Lewis, Washington, D. C., assistant to the president, United Mine Workers of America; Percy Tetlow, Washington, D. C., special representative of the United Mine Workers of America; W. K. Hopkins, Washington, D. C., senior counsel, United Mine Workers of America; and John T. Jones, Cumberland, Md., president of District 16 and legislative representative, United Mine Workers of America.

Copper Consumption At New High Level

In January consumption of domestic copper reached a new record level with a total of 119,736 tons shipped to consumers. Previous record was 112,671 tons, shipped in December, and the January output represents an increase of 7,065 tons over the shipments of the previous months. At the same time there was a reduction of 26,431 tons in refined stocks of copper in January. At the end of the month stocks totalled 116,341 tons compared with 142,772 tons on hand at the end of December. Stocks of blister copper also dropped 9,948 tons in January, making a total decrease in refined and blister stock of 36,379 tons of copper above ground. Exports of domestic origin copper were practically nil in January as in December.

At this rate of consumption total supplies of refined copper in producers hands is equivalent to less than a month's needs.

Copper Mine Produces At Capacity

The Bagdad Copper Corporation of Hillside, Yavapai County, Ariz., has been operating at the full capacity permitted by their available water supply and the existing mill equipment. During 1940 approximately 1,540,000 pounds of copper were obtained from 73,600 tons of ore. The copper concentrates were trucked to the Hillside railroad station for shipment to the smelter. J. W. Still is superintendent of the mine.

A. I. M. E. Annual Meeting in New York

The annual meeting of the American Institute of Mining and Metallurgical Engineers was held in New York on February 17 to 20, inclusive. Attendance was large and enthusiastic. In addition to widely-attended technical sessions and the usual committee meetings, many special features were provided, including get-together luncheons and dinners for the Institute members. The ladies' entertainment committee provided a full schedule of entertainment for women members and wives attending the meeting.

The technical program got under way a day early when the Division on Mineral Industry Education convened at the Columbia University Faculty Club on Sunday afternoon, February 16, under the chairmanship of W. R. Chedsey. These sessions were continued on the following two days and the general subject of the papers and discussions was the relation of education to the mineral industry. Sessions on mining methods were held on Tuesday and Thursday, with a program devoted to health and safety in mines on Wednesday. A symposium on block caving and another on rock bursts were conducted as part of the program.

Other sessions were devoted to Eastern magnetite mining and milling methods, milling methods, and meetings of the Iron and Steel Division. Papers on non-ferrous metallurgy were heard at two sessions on Monday, and those interested in mining geology had sessions on three days. A series of meetings were also held to discuss phases of geophysics. The Industrial Minerals Division (nonmetallics), the Coal Division and the Petroleum Divisions had meetings devoted to their respective interests.

At noon on the first day an All-Institute luncheon was held in the ballroom of the Commodore Hotel. The speaker on this occasion was George C. Bateman, Controller of Metals of the Canadian Ministry of Munitions and Supply, and president for 1940 of the Canadian Institute of Mining and Metallurgy. He talked informally on the organization of the mineral industry in Canada for carrying on the war. On Monday evening while the ladies were entertained at a dinner at the Women's National Republican Club and later went to a theater party to see Ethel Barrymore in "The Corn is Green," the men met for a smoker and dinner at the Grand Ballroom of the Commodore Hotel. A floor show complete with high-stepping dancers followed the dinner. On Tuesday evening members met at an informal dance at the Starlight Roof of the Waldorf Astoria. The annual banquet and president's reception was held on Wednesday evening at the Grand Ballroom of the Commodore Hotel. At the banquet medals and honors were awarded as follows:

The William Lawrence Saunders Gold Medal to Herman C. Bellinger for distinguished service to the mining industry; the Anthony F. Lucas Medal to Conrad Schlumberger, posthumously, and Marcel Schlumberger, his brother, for development of the art of electrical logging; the Charles S. Rand Gold Medal to Robert Crooks Stanley for his pioneering leadership during a period of active growth and development of a worldwide enterprise involving the mining of nickel ores, the metallurgical treatment thereof and the expansion and diversification of world markets for nickel products: the Robert W. Hunt Award for 1941 to Alden B. Greninger and Alexander R. Troiano for their paper entitled "Crystallography of Austenite Decomposition"; and to G. E. Steudel for his Institute paper entitled "Effect of the Volume and Properties of Bosh and Hearth Slag on Quality of Iron"; the J. E. Johnson, Jr., Award to Carl F. Hoffmann for his Institute paper entitled "Manufacture of Low-Silicon Pig Iron Using High Blast Temperatures."

JOHN R. SUMAN
Incoming President

John R. Suman was introduced as the incoming president of the Institute.

Large Dragline Dredge Placed in Operation

The largest dragline dredge in the world has been placed in operation on holdings of the Dayton Dredging Company in the townsite of Dayton, Nev. The walking dragline is equipped with a 17-ton bucket and is powered by a 650-hp. motor. Equipment includes a ballmill, 32 jigs, screens and a washing plant, and will handle 10,000 cubic yards of gravel daily. The dredger works to a depth of 140 feet and possibly to 160 feet. P. S. Crocker is manager of the Dayton Dredging Company.

To Test Manganese Mine

Investigating a manganese property in the Artillery Peak section north of the Bill Williams River in Mohave County, Arizona, engineers for the U. S. Bureau of Mines have completed considerable diamond drilling and are contracting for the driving of a tunnel to tap the deposit.

One of the largest deposits of manganese ore known in the United States is reported as found in this district, but an economical method must be provided for beneficiating the ores to the grade required by the government marketing system.

It is planned to handle at least 2,500 tons of the ore through pilot mills for experimentation to determine the manner in which the ore can be economically beneficiated.

Tungsten Released From Government Stock Pile

Materials accumulated for stockpile by the government are beginning to serve the purpose for which the stockpiles were planned—that of relieving shortages in strategic minerals.

Part of the government-held stockpile of tungsten was released in February to relieve a temporary stringency in spot supply of this metal and to assure adequate deliveries to industry, it was announced by W. A. Harriman, chief of the Materials Branch, Division of Production, Office of Production Management.

Authority to sell government stocks to industry was granted to the Procurement Division of the Treasury Department under an Executive Order signed February 4. The order authorizes the Procurement Division to sell or otherwise dispose of its tungsten stocks for defense production "to such buyers or users and in such amounts as may be requested from time to time by the Office of Production Management."

A temporarily tight situation developed in the available supply of tungsten as a result of the closing of the Burma Road last fall. Reopening of the road again makes Chinese tungsten available to this country and large quantities are presently afloat to the United States from the Far East.

Applications from industrial users for purchase of government stocks of this ore are made to the Procurement Division and granted upon approval of the Office of the Production Management. Sale price is the same as the cost of acquisition to the government.

It is expected that only part of the government stock need be released to assure supplies for refiners until such time as new imports are available. Release of stocks held by the Procurement Division also will minimize the possibility of price fluctuations in tungsten which might have resulted if this ore had not been made available to industry.

Tungsten, an element required to give alloy steels high tension characteristics, is important to defense production. It is particularly in demand for use in high speed tool steel. The United States is the second largest producer of tungsten in the world but normally imports about 50 percent more than it produces.

Developments Under the Bituminous Coal Act

The Bituminous Coal Act establishing minimum prices for soft coal became effective on October 1, 1940, and will expire on April 26 of this year, unless renewed. In February Senator Guffey of Pennsylvania introduced in the Senate, Joint Resolution No. 32, which would extend the provisions of the Act for two years from the latter date. A similar Joint Resolution (H. J. Res. 101) has been introduced in the House by Representative Boland of Pennsylvania.

The Bituminous Coal Division of the Department of the Interior announced recently that it had issued an order granting an application to restore the Bituminous Coal Code membership of the first producer whose membership had been ordered revoked for wilful violation of the minimum prices. The producer was the Dunreath Coal Co., Knoxville, Iowa. The company's membership was revoked as of February 4, on a complaint filed by the Producers' Board for District 12, and charging that the company had sold coal at prices below the effective minimums. As a prerequisite for restoration of its code membership, the company paid $556.45 in federal taxes, this amount representing double the 19½ percent tax on the coal involved in the transaction which led to the order revoking the producer's code membership. After revocation of code membership the producer is also subject to a 19½ percent tax on all subsequent coal sales until such time as his membership is restored. A producer, however, is not subject to this tax on sales made after his code membership is restored, as long as he remains a code member in good standing.

Technologists Needed in Government Service

The U. S. Civil Service Commission at Washington, D. C., has issued a notice that technologists are needed in government service in connection with national defense work. The positions open are in such branches of technology as explosives, fuels, plastics, rubber, minerals and textiles. Applications for these positions will be rated as received until December 31 of this year. Duties of the positions include the planning, conducting and reporting of investigation or research in some specialized branch of technology such as explosives, fuels, plastics, rubber, minerals, and textiles; or the testing, designing, or manufacturing of the materials essential for the successful operation of an industrial plant where such plant operation is based on some specialized branch of technology. Salaries in the several grades range from $2,600 to $5,600 a year. Competitors will not be given a written test but will be rated upon their education and experience.

A similar appeal has been issued for chemical engineers. Applications are to be rated as received until further notice. Salaries range from $2,600 to $5,600 a year for the various grades of positions open. Engineers with experience in strategic mineral research are especially needed by the Bureau of Mines of the Department of the Interior. Appointees will perform engineering work in such fields as pilot plant investigation, design and installation of equipment, and correlation of research data in the specialized branches of chemical engineering in which the appointments are made.

Information regarding these positions and application forms may be obtained from the U. S. Civil Service Commission, Washington, D. C.

Committee Reports on Emergency Conservation of Manganese

In July, 1940, a Technologic Committee on Manganese of the National Academy of Sciences was appointed with Clyde Williams, Director, Battelle Memorial Institute, Columbus, Ohio, as chairman, to consider the question of emergency conservation of manganese. In February John D. Biggers, Director of the Production Division, Office of Production Management, Washington, D. C., made public the report of the committee.

The committee recommended two measures in particular: (1) The use of spiegel as a substitute for ferro-manganese; and (2) the emergency conservation of manganese through consumer-producer cooperation. Twenty percent of the consumption of ferro-manganese could be saved by emergency conservation according to the report, and the committee pointed out that in the substitution of spiegel for ferro-manganese, certain domestic ores are available for production of spiegel, and production facilities could be built in sufficient time to cover the emergency. Spiegel is an alloy containing about 20 percent manganese.

Zinc Committee Appointed

At the request of E. M. Hopkins, Minerals and Metals Executive of the Priorities Division of the Office of Production Management in Washington, the American Zinc Institute, at a meeting in New York in February, appointed a special advisory committee to furnish to the proper officials in Washington, information and data regarding zinc production and distribution to the end that defense requirements may be provided for with a minimum of disturbance to civilian needs. John A. Church will represent the Office of Production Management at committee meetings.

New By-Product Ovens

Contracts have been let to the Koppers Company of Pittsburgh for the construction of two complete batteries of coke ovens, with by-product recovery equipment, the two contracts having a combined value of more than $10,000,000.

The Monessen Coke and Chemical Company, a subsidiary of the Pittsburgh Steel Company, will install 74 Koppers-Becker ovens at Monessen, Pa., adjacent to the blast furnaces of the steel company. The ovens will have a total capacity of approximately 700,000 tons a year. A new plant will also be built for the recovery of tar, benzol, tuluol, phenol and sulphate of ammonia.

The Weirton Steel Company, a subsidiary of the National Steel Corporation, will build an additional battery of 45 coke ovens, of the same type as the ovens to be erected at Monessen. Ovens built under this contract will have a capacity of approximately 400,000 tons a year, and will be an addition to 111 Koppers ovens already at this plant.

Getchell Mine Expanding

Company officials have announced that additions will be made this year to the mill at the Getchell mine in Humboldt County, Nevada. This mine is the largest gold producer in Nevada and the mill treats at the present time approximately 29,000 tons of ore monthly.

—Correspondence—

To the Editor

DEAR SIR:

I would like to add a word to the discussion of the role of mining geology. Does Mr. Sales really believe that the science has reached the stage where ore discovery can be accomplished without the aid of "hunches, chance and Lady Luck?" The return that capital expects from mining indicates that geologists cannot yet be found who are sure of bringing home the bacon. As more and more of the rules of ore deposition become known, the percentage of error in geological prediction decreases, but there are still many undiscovered faults a few rounds ahead of the face that cut off the ore without warning from the geologist.

We sometimes wonder what percentage of facts that will make economical ore discovery certain have so far been added to the store of human knowledge. Modern jargon in many cases seems to be restatement of facts learned in practice and already applied by rule of thumb methods. The old time German miner who learned to find copper under an "eisener Hut" was a geologist in the same sense that a present day miner soon learns to crosscut either to foot or hanging when he loses his vein. The old miner neither knew the word supergene nor understood the process of leaching the outcrop. Nowadays geologists explain echelon ore bodies but the explanation is usually made after the mine is worked out and all surrounding facies are exposed. In other words the rule of thumb method has done the work and afterward the geologist makes a record and offers an explanation. Such was bound to be the procedure in the science's infancy. It can claim real progress when it learns to lead instead of following. As yet it has not reached that point.

Mr. Sales cites examples to show how geologists might have made possible the discovery of outstanding districts if their outcrops had been less prominent than they are. Here is a challenge, to those who believe as he does, to go out and find a Comstock Lode hidden by insufficient or excessive erosion. The theory of probability indicates that some such undiscovered ore bodies exist. But I am not aware that geologists have discovered any large districts. The reason is clear. Mining capital recognizes that such search would be very speculative and will not risk the money. Only in the case of the extension of known bonanzas has success been met in such exploration. The conclusion inevitably is that geological exploration is still highly speculative.

It is worth citing the case of one of the most recently discovered mines of importance. It was found by an old prospector in Nevada, who "liked the looks" of a leached outcrop. It was too much of a gamble for mining geologists, who would not have money put up until speculators who were not geologically advised had found an ore body. It would appear that in this case geologists did not even explain the "eisener Hut."

I do not want to seem opposed to the work of the geologists. On the contrary I think everything is to be gained by adding to our knowledge in this way. But I do think that we should be realistic, figure the chances and play our cards close to the belly. It seems to me that Mr. Sales over estimates the present possibilities of the geologists' services and that Mr. Joralemon has outlined the case more practically.

Yours very truly,

HOMER C. NEAL.

Gold Is Where You Find It

A peculiar situation was reported recently by the *California Mining Journal.* Last year the California Debris Commission requested that the United States Government withdraw certain lands from the public domain, for the purpose of constructing a debris dam. The lands were on the American River, 12 miles from Auburn, Calif. After obtaining permission to construct a dam at that point to prevent pollution and silting of the lower stream, the Debris Commission started work on the project—called the Ruck-A-Chucky Dam.

During the course of excavation a slide occurred and a casual examination disclosed good values in gold in the slide. The dam workers started a gold rush and then, to permit the exploitation of the deposit in an orderly manner, formed the Ruck-A-Chucky Partnership. Since March last year the partnership is believed to have taken $30,000 worth of gold out of the diggings.

The *Journal* reports that the United States Government is ready to take court action to recover the money on the basis that the gold was found on land withdrawn from the public domain and that consequently it belongs to the government. This action has been withheld until after April 1, to give Congressman Harry Englebright of California, opportunity to obtain Congressional action in Washington on a bill to give the workers title to the gold.

Gold is where you find it, but in this case the question is, who owns it after it is found?

Idaho Maryland Mines to Add Plant at New Brunswick

Sinking at the New Brunswick mine of Idaho Maryland Mines Corporation is being continued to the 4,000-foot level. A new surface plant is planned by the company for handling deeper development.

The new steel headframe will contain multiple ore bins and crushers and will be higher than the one at the company's Idaho Maryland mine. Other equipment will include a 480-horsepower Nordberg single-drum hoist, a 600-horsepower Ottumwa double-drum hoist, and two 425-horsepower compressors.

Correction

In the Silver Review for the year 1940, by Walter E. Trent, in the February issue, production figures quoted in the first paragraph were preliminary estimates. Final production figures should have been substituted, as follows:

	Ounces	Value
1940	71,109,457	$50,566,725
1939	65,565,024	44,504,743
1915	74,961,075	37,397,300

In the second paragraph, the increase of 10.4% noted for 1940 should have read 8.0%.

Coking Qualities of Coal Can Now Be Predetermined

In a paper released at the recent meeting of the A. I. M. E. in New York, Dr. H. H. Lowry, director of the Coal Research Laboratory of the Carnegie Institute of Technology, announced the establishment of a formula whereby an analysis of coal, correlated with the temperature at which it is to be coked, accurately forecasts the resulting qualities and amounts of coke and its by-products of tar, gas and ammonium sulphate. Formerly only actual coking tests of particular coal could determine this question. Economy results in the use of the formula by eliminating costly oven tests formerly required. Employment of the formula results in an ability to forecast what results any particular type of coal will give under coking.

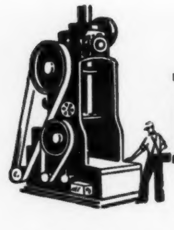
The result is the culmination of six years of research on the part of Dr. Lowry with the assistance of H. G. Landau and Leah L. Naugle in the Coal Research Laboratory at the Institute. Dr. Lowry revealed that one large steel company has been able to save many thousands of dollars in the past year in the single item of eliminating the sulphur analysis of coke, through employment of the formula.

Coeur d'Alene Mine to Deepen Shaft

A new heavy duty electric hoist has been installed at the mine of the Coeur d'Alene Mines Corporation at Kellogg, Idaho. The completion of this hoist makes possible the exploration of the company's property at great depths, and soon a start will be made on deepening the shaft from the 1,400-ft. level to the 1,600-ft. level, and later to the 2,000-ft. level. This deeper development work will be awaited with great interest by mining men of the district because the mine workings are on the north side of the Polaris fault. The Sunshine, Crescent, Polaris and Silver Dollar mines are all on the south side of the fault and this contemplated development will be the first test in depth on the north side.

Galbraith Iron Mine to Have Washery

Butler Brothers, independent miners and shippers of iron ore from the Mesabi and Cuyuna iron ranges of Minnesota, are building a new ore washing plant to serve the Galbraith iron mine, now being stripped. Work, started last fall, calls for the removal of 1,500,000 cubic yards of overburden by power shovels and trucks. The ore treatment plant will employ standard Mesabi ore washing practice and will have a capacity to treat 600 tons of crude ore per hour. The Galbraith mine is located near Nashwauk, Minn., Mesabi iron range. It is one of the fee properties of the Great Northern Iron Ore Properties.

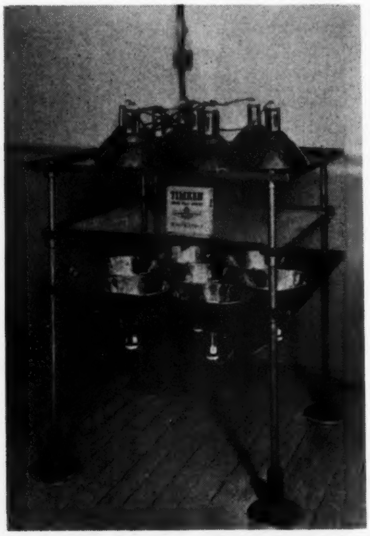


MANUFACTURERS' Forum

Bearings Heated to Give Tight Press Fit

The Timken Roller Bearing Co., Canton, Ohio, has developed a novel method for heating bearing cones, preparatory to assembling them on shafts where a tight press fit is required.

This device consists of three trays about 4 feet square, approximately 12 inches above each other. The middle tray is of pyrex glass while the



top and bottom trays each carry seven 250-Watt special infra-red ray bulbs. The reflectors of the bulbs are gold-plated.

Bearing cones are stacked on the tray still in their containers. About 20 minutes are required to heat a bearing up to a maximum of 155° F. The infra-red rays penetrate the boxes and heat the steel, but leave the cardboard relatively cold.

With this method of heating, it is not necessary to wash off the protective coating which is put on the bearings at the time of packing.

Stephens-Adamson Announce Addition to Line of Sealmaster Bearings

Stephens-Adamson Manufacturing Co., Aurora, Ill., announce an important addition to their line of Sealmaster Ball Bearing Units—the Style "A" Extended Inner Ring Bearings.

These bearings are for machine application on straight shafts. They are permanently sealed, pre-lubricated, fitted with location snap ring to permit through bore in housing, and are easily and securely locked on shafts with either knurled cup point set screws or one-half dog point set screws with lock wire.

Bulletin 740 giving complete information will be furnished upon request to this publication or to the company.

Denver Equipment Company Describes New Mill

The Denver Equipment Company, 1400 Seventeenth St., Denver, Colorado, has issued a pamphlet describing the Pride of the West mill at Howardsville, Colorado, designed and built by that company. A complete description of the mill is given as well as a detailed flow sheet and numerous photographs showing the construction and operation of the mill.

Shoe Developed for Heavy Duty Current Collection

The Ohio Brass Company, Mansfield, Ohio, announces development of a new shoe or glider for collecting current from standard trolley wire overhead systems, designated as the O-B Type L Shoe. Recommended for use on locomotives which require more current collecting capacity than is provided by trolley wheels or light shoes, the Type L Shoe is cast in one piece.

An outstanding feature of the Type

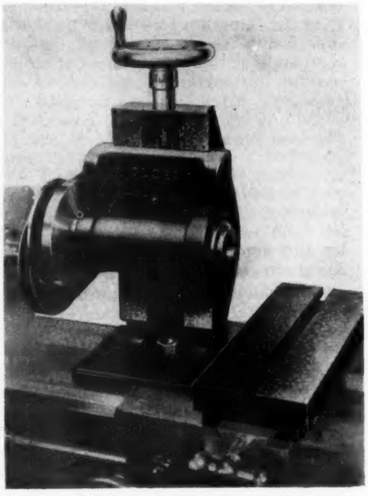
L design is the method of mounting the shoe in the harp. The pivotal center of the shoe is located in the center line of the wearing surface. With this location as a pivot there is no tendency for the shoe to tilt because of the friction between the wire and the shoe. Consequently, the shoe is always held with the full length of contact against the wire whether the locomotive is standing still or going in either direction.

Chemistry in Mining

The use of chemists and chemicals in prospecting, in identifying minerals, for metallurgical purposes and ore concentration has become of such widespread importance that the American Cyanamid Company is inaugurating a national advertising campaign, directed to business executives generally, in news magazines such as *Time, Fortune, News Week, Business Week*, and others.

New Milling Head for Lathes

The Globe Products Mfg. Co., 3380 Robertson Blvd., Los Angeles, Calif., are introducing a milling attachment which makes a milling machine out of any lathe. The Globe milling head employs the lathe spindle for its drive and makes use of the carriage movements to operate its table. The spindle is carried on a vertical slide so that the spindle can be positioned or



moved up and down. Among other accessories enabling the operator to cover a wide variety of work, is a ball bearing arbor support for attachment to the lathe tailstock spindle so a cutter arbor can be applied in manner similar to that on a standard plain milling machine with an overarm. It also is possible to mount a chuck on the end of the arbor at the milling head in raised position and set a standard lathe tool on a block on the carriage to swing larger work in a turning operation than the lathe will take on its own headstock.

Originally developed in 1939 and

distributed in the Southern California district only, this tool is now available nationally for Atlas and Craftsman lathes (other than 6-in. sizes), 9-in. and 11-in. South Bend lathes, and 10-in. and 11-in. Sheldon lathes. The head may also be attached to other makes of lathes, or to larger sizes, by the use of a special adapter base plate, a slight change in the cross-feed screw nut and necessary machining of the base of the column and the table.

"De-ion" Enclosed Circuit Breaker

A new "De-ion" enclosed circuit breaker designed for protection of all types of light and power circuits is announced by Westinghouse Electric & Manufacturing Company, East Pittsburgh. This new type AB-1 breaker is made in four frame sizes, including ratings from 15 to 600 amperes in steps corresponding to commercial wire sizes. All are available with voltage ratings from 250 volts a-c, 125/250 volts d-c to 600 volts a-c, 250 volts d-c.

Distinctive features common to all frame sizes are: silver contacts operated by a toggle mechanism to provide a quick "make" or "break" action; bimetal thermal elements to prevent tripping due to harmless overloads; rust and corrosion resisting metal parts; and the "de-ion" method of arc quenching. This feature confines, divides, and extinguishes the arc almost instantly as the contacts open, providing long contact life and reducing the fire hazard.

Enclosed in a water and dust tight sheet steel case, the breaker requires a mounting space 40 percent less than for conventional fused safety switches of the same ratings.

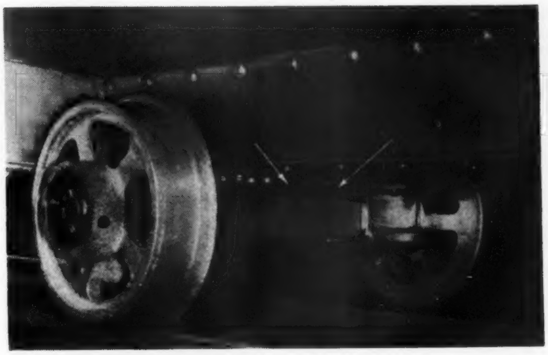
A complete line of these breakers is available for hazardous locations classified by the National Electrical Code and by Underwriters Laboratories, as Class I, Group D and Class II, Group G.

Rubber Liners for Stamp Mill

The B. F. Goodrich Company, Akron, Ohio, has issued a report on the operation of a rubber-lined stamp mill handling quartz ore at the plant of a large western company.

This company had always considered that one inch manganese steel plate was the only material which could resist the impact of the highly silicified ore. As an experiment, Armorite rubber ¾ inch thick, consisting of one piece 18 by 90 inches and two pieces 18 by 86 inches were employed as lining in the mill. After more than 3,000 tons of the abrasive ore had been crushed on this mill, the company told Goodrich engineers that the rubber lining shows practically no wear and very little "roughing up," while a similar tonnage would have worn down manganese lining from ⅓ to ½ of their original thickness. The company also reported that the Armorite, in addition to being less costly than manganese steel can be installed in less time.

Rubber Springs for Mine Cars

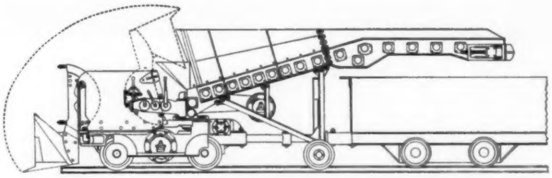


The United States Rubber Company announces the development of rubber springs for mine cars. According to the manufacturer, these springs offer a number of advantages over conventional steel springs, such as have been used for many years. Among the advantages claimed are the following: Better spring action; quieter ride; greater dependability; increased economy; and greater safety.

The rubber springs are introduced on the new, streamlined, all-steel car built by Irwin Foundry & Mine Car Company, of Irwin, Pa., for the Kehoe-Berge Coal Company of Pittston, Pa. Three hundred cars thus equipped are to be placed in service this spring.

Two types of rubber springs are employed. One is a shear type and the other a compression type. The shear spring carries the load while the car is empty; there are four on each car. The compression spring carries the total load of car and coal. There are four of these latter springs on each car, and they can carry a total load of 19,000 pounds. There is no metal to metal contact between the car axle and the car itself; as a result, noise and friction are reduced.

New Eimco Tunneloader



The Eimco Corporation of Salt Lake City announces the development of a new mucking machine, the "Tunneloader," which is not only larger and more powerful than any of their present models but also embodies a number of new features which permit loading the largest cars underground with unusual speed and economy. The new Tunneloader retains the famous Eimco-Finlay rocker-arm mucking action. The bucket is crowded into the muck pile by the machine's self-tramming power, and the bucket and rocker-arm assembly rolls over backward on a supporting track to its dumping position against the bumper springs. In the new loader, however, two important improvements have been made in the mucking action—one is the introduction of a separately powered self-locking worm-and-gear mechanism for swinging the bucket assembly to any desired digging position without manual effort by the operator. The other is the elimination of the need for "centering" the bucket assembly before dumping. This latter advantage has been made possible by the introduction of a hopper into which the bucket discharges direct from any digging position instead of dumping into a car and having to be lined up with it first, as was the case with the smaller-sized Eimco-Finlay Loaders.

The use of a hopper, which feeds the rock onto a short belt-conveyor permits loading cars having bodies up to 15 ft. in length and 6 ft. in height above the rail. The conveyor is separately powered and can be started or stopped by the loader operator from his normal position. He can also vary its speed within a wide range by the same conveniently located control lever.

Link-Belt Speeder Corporation Issues Publication

The Link-Belt Speeder Corporation, 301 W. Pershing Rd., Chicago, has started issuance of a new publication, *Link-Belt Speeder News*. The *News* will be issued monthly in the interest of the company's line of shovels, draglines and cranes. A newspaper make-up is employed and the first issue, March 1941, features news of operations in the field employing the company's line.

INDEX TO ADVERTISERS